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Jacob Perkins Esq^{r}

Civil Engineer.

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THE

MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE.

VOLUME FIFTEENTH.

"He that would be quiet, let him repair to Philosophy—a study that has credit with all sorts of men. The world can never be so wicked but that the very name of a Philosopher shall still continue venerable and sacred."—*Seneca's Morals.*

London:
PUBLISHED BY M. SALMON,
MECHANICS' MAGAZINE OFFICE,
WINE-OFFICE-COURT, (BETWEEN 145 AND 146) FLEET STREET.

M.DCCC.XXXI.

PRINTED BY M. SALMON
119, FLEET STREET.

PREFACE

TO

THE FIFTEENTH VOLUME.

THE salutary tendency of the arts and sciences is happily no longer a matter of dispute; but if it were, the simple fact, that during a time of so much political agitation and excitement as the present, the different journals through which the votaries of science are in the habit of making their discoveries and speculations known to the world, should manifest an increase, instead of any falling off, in fertility and vigour—ought of itself to confound all scepticism on the point. We consider this to be universally true of the scientific portion of the periodical press of 1831; and know it to be so, in an eminent degree, with respect to the journal under our immediate superintendence. At no stage of our career—now one of considerable duration—have the spontaneous contributions to our pages been more numerous, or of greater value, than during the period of trouble embraced by our present volume; a fact the more remarkable, that the majority of the correspondents of the MECHANICS' MAGAZINE are, as usual, to be found in the busier walks of life, where a concern for private as well as public affairs, might be supposed to operate most injuriously, to the peaceful pursuits of philosophy.

When society is in that state, that men can turn with calmness of temper, from a question of "What will the Lords do?" to inquire "What is the best means of preventing explosions?" it is a certain proof that knowledge has gone far to achieve one of its best triumphs—that of gaining men over to a perfect dependance on the force of reason for the ultimate redress of whatever there is amiss in their social condition. Science has never yet been found leagued with precipitancy and violence, and we feel well assured never will.

Nor can it be said, that it is because none of the evils of bad government reach to the sphere of Science, that her votaries are thus tranquil and patient. On the contrary, the path of the philosophical student, is at every step beset with difficulties, which tell of absurd and vexatious interference, and give him cause to hope, like others, much from Reform. It would actually seem, from the manner in which Science is thwarted and obstructed in her pursuits by fiscal regulations, as if she were thought to be pregnant with all manner of wickedness, instead of being, as she is, an overflowing and unfailing source of national wealth and power. The astronomer cannot study how to improve his glasses without having an exciseman at his elbow; the mechanic cannot present his country with a new machine, without being taxed some hundred pounds for the gift; the journalist cannot tell the people by what new inventions and improvements their productive powers may be assisted and increased, without being levied upon for the communication of the welcome tidings. The cultivators of scientific knowledge feel acutely, that they are subject to many peculiar hardships; nor are they blind to the multiplied chances of relief which would be afforded by a Legislature that truly represented the people and their interests; but, accustomed to discard accidental forces from their calculations, they rest all their hopes of a beneficial change on the sure though slow progress of intellectual illumination. The lamp is their only weapon; and with that, they make sure in time, of conquering the world.

Were it in our power, to do justice to the degree, in which each of the many friends and correspondents, who continue to favour us with their support, has contributed to the valuable contents of our present volume, we should have a most gratifying task to perform; but as such a comprehensive specification is impossible, and selection might offend more than it pleased, we must content ourselves, with tendering them generally, our heartfelt thanks, for their able and zealous endeavours, to sustain the high character which the MECHANICS' MAGAZINE has attained as a repository of original and useful information.

We expected that our present volume would have included the abridgment, which was promised (vol. xiv. p. 34) by our esteemed friend and correspondent, Mr. Woollgar, of the Logarithmic Tables of Gaus, as amplified by Matthiesen; but though in this we have been disappointed, we are happy to learn that the abridgment is in progress, and will probably be ready for publication before we reach the close of another half year. To the valuable Logarithmic Tables which Mr. Woollgar has already furnished to our work, this will be a most important addition. The Tables of Gaus and Matthiesen, though better adapted than any others, to a number of calculations, have never yet been printed in this country, and will appear for the first time in an English form in the MECHANICS' MAGAZINE.

Wine-Office-Court, Sept. 30, 1831.

ERRATA IN VOL. XV.

P. 97. In the engraving of the Portable Hand-mill, for "fig. 2" read "fig. 4;" for "fig. 4" read "fig. 3;" and for "fig. 5" read "fig. 2." The figure which is without any numeral should have been marked fig. 5.

P. 112, col. 1. l. 3 and 10 from the bottom, for "Wesley" read "Watts." See Minor Correspondence, p. 128.

P. 168, col. 2, last line, for "Ethick" read "Ettrick."

P. 263, col. 1, l: 13, for "10 of 17" read "10 of VI."

———————— 32, 41, and 45, for "rectangular" read "rectangle."

———— col. 2, l. 24, for "of" read "or."

——————— 29, dele the period after "parallelogram."

——————— 34, for "hypothenuse" read "hypothesis."

— 264, col. 2, l. 8, for "Proposition" read "Proportion."

— 293, col. 1, l. 21, for "was" read "in as."

———————— 36, for "hydrometer" read "hygrometer."

——————— 56, dele "an."

———— col. 2, l. 4, for "our' read "one."

———————— 27, for "wind" read "mind."

— 294, col. 1, l. 43, for "three" read "those."

———————— 46, for "Huygens" read "Halley."

———————— 48, for "narration" read "variation."

———— col. 2, l. 1, for "when" read "where."

———————— l. 36, for "tracing" read "tracers."

— 295, col. 1, l. 34, "for "lunar" read "linear."

———————— 37, for "nights" read "heights."

— 314, col. 1, l. 18, for "when" read "then."

——————— 2, l. 50, for "durable" read "double."

———————— 51, for "atmometer" read "anemometer."

— 320, col. 1, l. 7 from the bottom for "our" read "an."

— 328, col. 1, bottom line, for "atmometer" read "anemometer."

———— col. 2, l. 3 from the bottom, for "meteor" "read "meter."

— 329, col. 2, l. 29, for "is" read "was."

——————— 42, insert after "certain" the word "time."

— 320, col. 1, l. 32, for "hand" read "band."

— 346, col. 2, l. 14, (and throughout the article) for "sympasometer" read "sympeisometer."

— 347, col. 1, 30, for $\frac{1}{d}$ read $d\frac{1}{2}$.

——————— l. 36, for $\frac{dc^3}{28500}$ read $\frac{d^2c^3}{28500}$

———— col. 2, l. 9, for "an acid" read "air."

⁂ For other errata, see the end of each Number.

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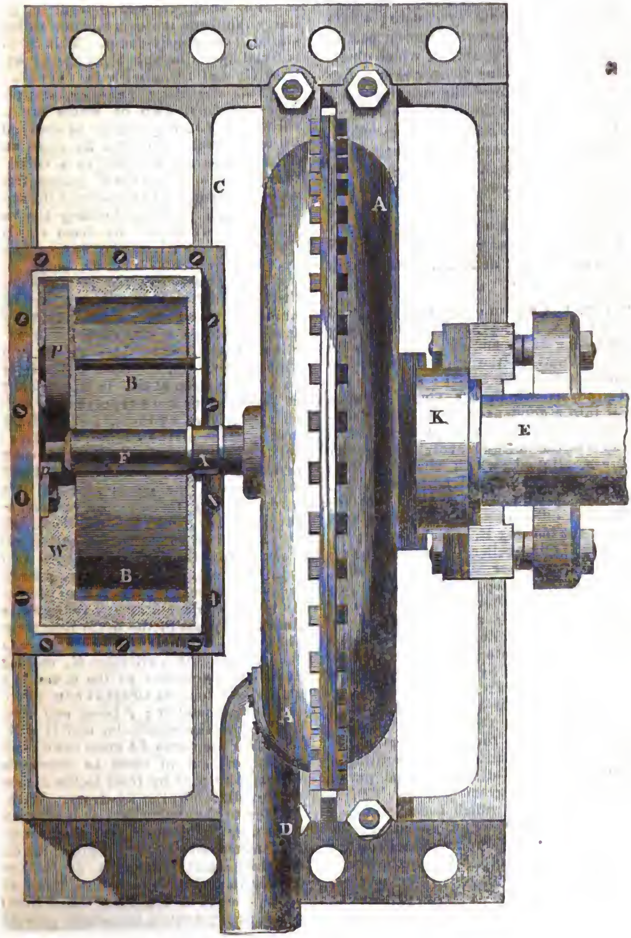
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 395.] SATURDAY, MARCH 5, 1831. [Price 3*d.*

ERICSSON'S STEAM-WHEEL.

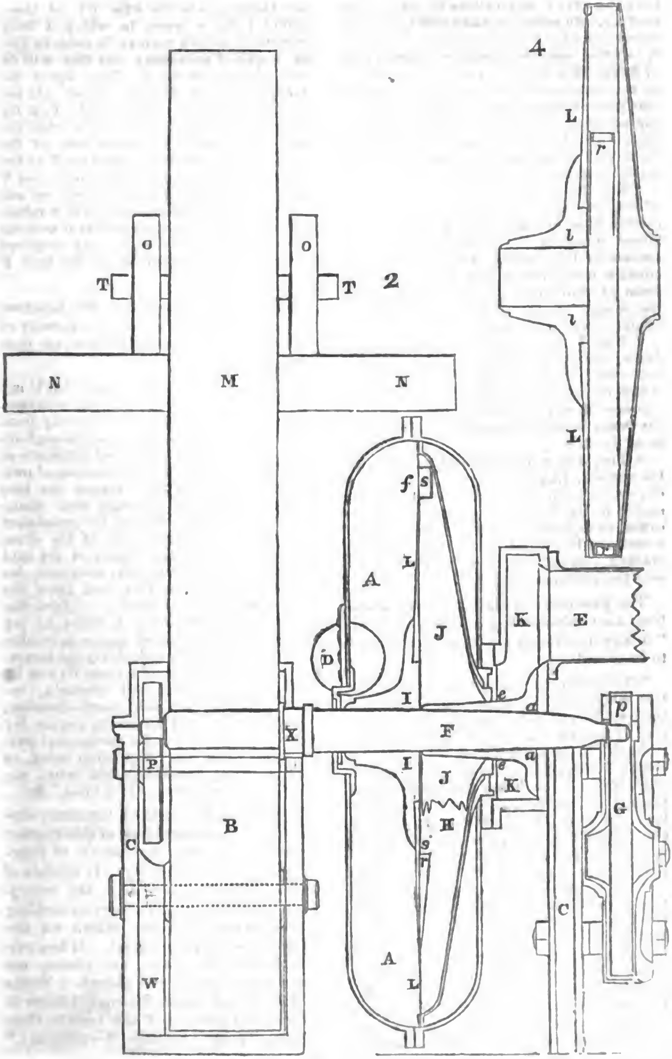


ERICSSON'S STEAM-WHEEL.

The present invention was secured by patent, granted to Mr. Ericsson on the 24th of July, 1830, and is there described as "an improved engine for communicating power for mechanical purposes." The specification, which was enrolled on the 20th of January last, declares the nature of it "to consist in producing a rotary motion, applicable to mechanical purposes, by causing steam to pass through channels forming part of a hollow revolving chamber, which channels are so formed as to oppose a resistance to the passage of the steam in such manner as to cause the said hollow chamber to revolve." The engravings which accompany our present notice are copied from a working drawing annexed to the specification, of an engine on this plan, of fifty horses' power, and the following explanatory description is in the patentee's own words, similar letters of reference being employed to denote similar parts in all the figures:—

" Fig. 1 is a plan of my said improved engine; AA is the fixed or stationary outer casing of the engine; and CC is the frame supporting the engine; D is the steam-pipe from the boiler; and E is the exit-pipe by which the steam escapes either into a condenser or into the atmosphere, as may be most convenient; F is the axis of the hollow revolving chamber before-mentioned, which chamber, from its peculiarly rapid and uniform motion, I call a fly-drum, and which revolves within the outer casing AA. This axis rests on the bearing B, which bearing is, in fact, a friction-roller, on which the axis is kept by the lesser roller P on one side, and by the brass step *p* on the other, as will be seen hereafter in another figure; the other end of this axis rests also upon a similar friction-roller, on which the axis is kept by a brass step, but which in this view is concealed by the steam-pipe E being placed above it.

" Fig. 2 is a view of my said improved engine, applied to the purpose of communicating power for mechanical purposes, as aforesaid, and representing a transverse section of its principal parts, the parts coloured green (M, NN, TT, O) being the media by which I communicate the power of the engine to other machinery not applicable immediately to the axis of the fly-drum. AA is a stationary outer casing, forming a steam-chamber, and fixed firmly to the frame-work CC, as shown in fig. 1. D is the steam-pipe from the boiler, opening into the steam chamber AA; and E is the exit-pipe for the steam after it has performed its office; F is an axis passing through the steam-chamber A, carrying the hollow drum or chamber before-mentioned, and supported at one end on the broad friction-roller B, and at the other on the narrow friction-roller G, as before-described, and kept on those rollers by the stop-rollers P and the brass step *p*. H is the said hollow drum or chamber, which from its peculiarly rapid and uniform motion, as before stated, I call the fly-drum. This fly-drum is fixed upon the axle F by means of the boss II, and turns with it. Within this fly-drum are three fixed or stationary vanes or fans, two of which are here shown at JJ, one being broken off to show the interior of the fly-drum at H. These vanes are attached to a collar *aa*, through which the axle F passes freely, and which screws to the side of the steam-passage KK, thereby holding the vanes stationary while the fly-drum revolves. On the surface LL of the fly-drum channels of a particular form are made, leading to apertures opening into the drum; these channels, as here shown, are of an oblong-square shape, formed in the surface LL of the drum, each being an inclined plane, with sides as at *r*, and dipping inwards, and open to the internal part of the drum at S. In this figure two of these channels are represented, and the effect produced by them, and the internal arrangement of the engine, as before described, will be as follows:—Steam being admitted into the close steam-chamber, AA, through the steam pipe, D, it will force its way through the channel *r* to the apertures S into the fly-drum, which will be drawn round by the action of the steam upon the inclined planes of the said channels, while the steam, prevented from following the course of the drum by means of the stationary vanes JJ, will find its way out of the drum into the passage KK, through the opening *ee*, and thence into the exit pipe E, causing a constant revolution of the drum H and axis F, so long as steam is admitted into the steam-chamber; *f* is an end view of one of the said channels, and it will be seen that the vanes JJ must have notches, or spaces, cut in them to allow these channels to pass by them in the course of the revolution of the fly-drum. With reference to these channels, it is absolutely necessary to observe that they must be so constructed that the length of the channel shall always exceed its depth in such proportion, that the channel itself shall always move at a greater speed than the steam acting against its bottom: for when



the length is to the depth, as, for instance, two to one, the motion of the acting steam towards the bottom of the channel will only be one-half as rapid as the motion of the channel itself. W is a close box filled with water, or other suitable fluid, to keep the axis F and rollers B and P from heating. In order to make this box tight where the axis F passes through, a collar X is fixed upon it, furnished with a rise or flange, the greater velocity of which, in consequence of its increased size at that part, will prevent the water from escaping during the revolution of the axis. The roller G, by which the other end of the axis F is supported, is furnished with a similar water or oil-box.

"Fig. 3 is a separate perspective view of one of the channels; and it will be proper here to state, that though an inclined plane is the best shape for the bottom of the channel, yet if it be sunk equally much below the surface of the drum at both ends, provided always that the length of the channel exceeds its depth, it will work well.

"Fig. 4 is a separate view of a fly-drum, with its boss H, and with the channels *r* made on the periphery of the drum, which is equally effective, and for which purpose it will be seen that the edge of the drum is made flat instead of sloping, as at fig. 2.

"Fig. 5 is a plan of the inner side of the surface, LL, of the fly-drum, showing channels, both on that surface, as represented in fig. 2, and on the edge of the drum, as represented in fig. 4, which may sometimes be desirable; the channels are marked *r*, and the parts marked I, represent the stationary vanes."

The patentee adds the following directions for applying the power of his engine "to any machinery not directly attached to its axis."

"This should be done by means of motion wheels, or rollers, pressed down upon the axis F, and to be turned by the friction of that axis against them; their peripheries being made somewhat rough by slight fluting, for the revolutions of that axis will be found too rapid to admit of cogged-wheels being used with advantage. The parts coloured green, in fig. 2 (M, NN, TT, O), represent such motion wheels or rollers, as aforesaid, as also part of the arrangements by which the necessary pressure is caused upon the axis F to set the said rollers and the machinery connected with them in motion. MM is a motion-wheel, or broad roller, placed vertically over, and resting upon the axis F of the fly-drum. NN is the axis of this roller; and as this axis serves for the main or driving shaft to which machinery may be attached in the ordinary way, I call the roller M the driving roller. OO are two rollers for causing friction, or pressure, and which I therefore call, by way of distinction, the pressure rollers. On the axis TT of these rollers I fix a lever, to which I hang weights, or attach springs, in order to give the required pressure; but this will be better shown in fig. 6. This figure represents an end elevation of my said engine and the rollers aforesaid; C is the cast-iron framing, on which is cast the knob or boss Q. The short arm of the lever R, which turns on the axis T of the roller O, acts against this boss, and V being a slide brass, moving freely up and down; as the driving roller MM is raised or depressed, it is evident that if weights be added to the lever R, any required pressure may be obtained on the axis F of the fly-drum."

The grounds on which Mr. Ericsson particularly rests his claim to novelty of invention in the present instance, are thus summed up:—

"And whereas it is evident that if my said engine were so modified and arranged that the steam was forced directly from the boiler into the fly-drum through its centre, in which case the full pressure of the steam would be inside instead of outside of the drum, and escaped out into the steam-chamber, through such channels as aforesaid, offering the resistance aforesaid, but opening out of the drum instead of into it, the object of my said invention would be equally obtained, for the exit pipe might then lead from the steam-chamber AA, instead of from the fly-drum. And whereas I claim as my invention the improved engine hereinbefore described, and particularly the steam-chamber AA, with the fly-drum H, and its particularly proportioned channels, revolving within the said steam-chamber, and which I call my improved engine for communicating power for mechanical purposes. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used," &c.

There is a great deal of ingenuity displayed in the construction of this engine, attended with that best result of ingenuity—extreme simplicity. It consists of fewer frictional parts than any rotary-engine we have yet seen—even excelling in this respect the one which we described in our last Number. It has neither beam, nor crank, nor piston, *not even a single valve;* and though it works by the help of *vanes*, the contrivances so called have nothing of the vane in their nature, being perfectly "stationary." (The inventor might with as much propriety have talked of motionless *winds* as of stationary *vanes.*) We must confess,

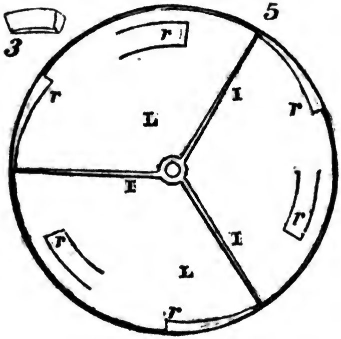
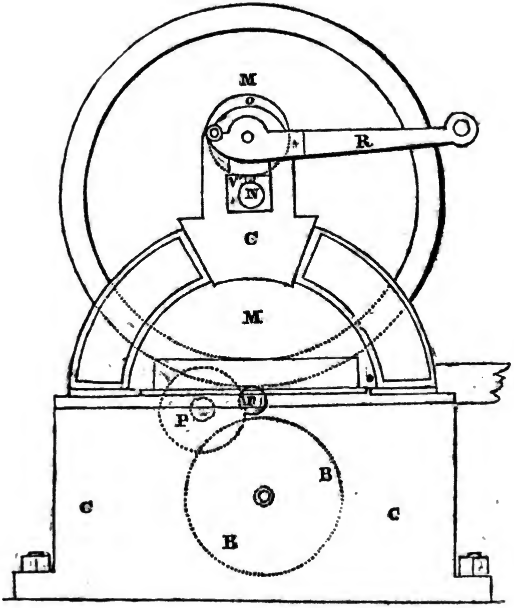


Fig. 6.



however, that we entertain considerable doubts as to the practical efficiency of the means proposed for transferring the motion of the wheel or fly-drum to the working of machinery. If the motion be "too rapid to admit of cogged wheels" being employed, we should think it must also be powerful enough to smooth down, in a very brief space of time, any mere roughness that can be given by fluting or otherwise to the periphery of a driving-wheel or roller. The patentee has provided, it is true, a sort of substitute for this roughness in "the pressure-rollers," by which his driving-roller may be made to press to any degree required on the axis of the fly-drum; but is he sure that the only effect of such pressure will be to make the driving-roller, that is pressed against the axis, go round? Is it not as likely that the axis may give way, and the *fly*-drum *fly* in pieces? To obtain an immense power by steam has never been a difficult matter; the difficulty has always been to bring that power under such controul that it could be made use of at will—and this difficulty, we think, has been only very partially overcome in the case of the engine now under consideration. If we are right, then will there be nothing paradoxical in saying, that this steam-wheel will be *powerless* because it is so *powerful*. If we are wrong, (which we shall be happy to find the case) then shall we be as free to confess, that it is at once the simplest and the best steam-engine which has ever yet been invented.

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DAWSON'S AUSTRALIA.* EMIGRATION.

Thanks to the controversies of the gentry who have sprung up like mushrooms in the literary world during the last few years, under the imposing name of Political Economists, and thanks, above all, to that indefatigable gentleman, the Right Hon. Wilmot Horton, who, in office or out of office, in the House of Commons or the Mechanics' Institution, Colonial Under-Secretary or Governor-General of Ceylon, ceases not to din into the ears of the much-enduring public the never-to-be-got-rid-of cry of "Emigration, emigration!"—thanks to him and the gentry aforesaid, the consideration of the question of the expediency and propriety of transporting some millions of our fellow-countrymen to the other side of the Atlantic, or the still more distant shores of New Holland, has become as "familiar to our mouths as household words." The Ministers, too, have, even while we write, applied their minds to the subject, and taken the Right Hon. Gentleman's plan under their especial protection, although it *was* shrewdly suspected that his appointment to a remote Governorship had been made chiefly to get rid of himself and his "plan" together, at least for a time. Be that as it may, however, it must be allowed that, "under existing circumstances," a book like that under review, professing to give an account of the present state of the vast island towards which the eyes of most emigrants and emigrationists are turned, can hardly fail to possess something of interest. Mr. Dawson, the author of it, was the agent of one of the few companies of the speculative years 1824 and 25, which did not prove mere bubbles. The object of its members was to found a new settlement on the shores of Australia, partly, we suppose, for the good of their country, and *partly* for their own profit. It will be seen that their first experiment was on a tolerably large scale:—

> "In the month of December, 1824 (says our author) I accepted the appointment of chief agent of the Australian Agricultural Company. In the March following I went to France to make purchases of Merino sheep, to be transported to New South Wales; and on the 24th of June, I embarked at Cowes on board the *York*, having under my charge about 40 individuals (men, women, and children) together with 323 sheep, 9 head of horned cattle, and a choice collection of British and other plants, selected for cultivation in the far-distant land of promise to which we were bound.
>
> "My nephew, Mr. J. G. Dawson, having been appointed my assistant, embarked at the same time on board the *Brothers*, having the charge of 40 individuals, between 3 and 400 sheep, 3 head of horned cattle, and 7 horses."—P. 2.

The director of such an expedition as this must have enjoyed the very best opportunities for forming a judgment on the advantages and disadvantages of emigration; that opinion, like, we believe, the opinion of most of those who have visited any of the "lands of promise," which are held up in such glowing colours before the eyes of those discontented with their situation at home, is rather adverse than favourable. He observes:—

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* The Present State of Australia; a Description of the Country, its Advantages and Prospects with reference to Emigration, and a particular Account of the Manners, Customs, and Condition of its Aboriginal Inhabitants. By Robert Dawson, Esq. late Chief Agent of the Australian Agricultural Company. London: Smith, Elder, and Co. 1830. 8vo. pp. 464.

> "If we could believe all that we are told of the facilities with which persons can establish themselves in new countries, and the benefits which are to be derived both to the emigrants and to those who are left to fill their places at home, the means of bettering the condition of mankind are of the easiest attainment and of the most gratifying nature; and one could never cease to wonder how it is, that so many of the good people of Britain should be such simpletons as to remain as they do, within reach of the promised blessings, without making a simultaneous effort to possess them. Nothing, indeed, can be more delightful than the pictures which have been presented to the public, and which have induced many to go in quest of the realities. Some few, perhaps, by dint of money and perseverance, may have been fortunate enough to find them, although I will venture to say, that the greater part have been disappointed and discomfited. The plans, however, which are sought to be carried into effect by those who wish well to their country and to their fellow-creatures, appear to have been formed for the purpose of relieving the country from the burthen of those classes who cannot support themselves at home; but I fear the principal effect has been, to *entice only the better and more profitable part of the population from their homes*, to encounter difficulties and privations *far greater than they had before experienced*, while the deserving paupers, the idle, and the dissolute, are *left in their original positions*, in which the great mass of them must remain until some means are adopted to *improve their condition upon their native soil*."—P. 445.

What can our wise Ministers say to this? Here is a man who has, at any rate, *seen* something of the operation of that system which they and their liberal friends are never tired of *talking* in praise of; and what is his report? That the Wilmot Hortonian plan is impracticable! That it would effect neither of its two grand objects—the bettering of the condition of those who emigrate, and the condition of those who remain at home! With such an opinion before them—and it is not singular—should not the "collective wisdom of the nation" pause, and ponder deeply, ere they give their sanction to a law, which authorises the formation of a parochial debt, likely soon to become as large, and as impossible to pay off, as the national one? Should they not consider, too, the consequences of that *not-impossible* event, the failure of the scheme to do all the good its promoters so confidently anticipate? Let us suppose, for an instant, that a few parishes in a certain district have shipped off their surplus population—that on arriving at the place of destination, the home of their adoption, the emigrants find it to resemble much more the pestilential marshes and arid plains of Poyais, than the Paradise they expected to find it—what are they to do? Are they to remain, and die a worse death, a thousand times, than the starvation they feared at home, while our humane legislators are rubbing their hands at the success of their plan for increasing the value of labour? Or are the parishes to mortgage the small unincumbered remainder of their poor-rates to re-transport them back to Old England? Or suppose matters not quite so bad as this, but that the price of labour increases at home in consequence of their absence, and that the settlers, not finding themselves quite so well situated as they could wish, manage, by their own efforts, to get "home" again—does my Lord Howick suppose they are to be starved, in accordance with the humane clause in his Act, that a returned emigrant shall be considered an outcast, shall even be *excluded from relief as a pauper?* As these men are all to be able-bodied labourers—the "halt and the lame" staying at home to be maintained out of that part of the poor-rate *not appropriated to paying off the mortgage*—what would be the situation of England if they were to return in any considerable numbers? But, then, it must be "their own fault" if they do not do well—and, after a year or two, become farmers on their own account! Listen again to Mr. Dawson—he speaks, indeed, only of Australia; but what superior advantages does Canada possess?

> "In describing the different quarters of the colony, or, at least, such as are worthy of notice, it has not been my intention to enter into very minute details, my object having been to describe generally each district in succession, so as to enable the reader to compare them with each other, and to have a general view of the whole.
>
> "Those persons who are desirous of emigrating to New South Wales, and into whose hands this work may fall, will probably be anxious to know in which quar-

ter of the east, or coast side of the mountains, good land, or such as it would be prudent to select, is to be found. To this I answer: that I can give them no satisfactory information upon that point, because I am not aware, and indeed I do not believe, that any good soil remains unlocated; and unless, therefore, they can *command sufficient capital* to enable them to purchase good land on the Hunter's River, or are prepared to go behind the mountains, and to encounter the difficulties I have before pointed out, *they had better stay at home.*

"Nothing can be more salubrious, or more delightful, than the climate of New South Wales, in every quarter which I have visited. The richness of some part of the soil in the numerous valleys, and the beauty of the scenery in those places, can hardly, in my imagination, be exceeded in any part of the world. If, therefore, a man, *possessed of means sufficient* (when added to the productions of the soil) for supplying the wants of his family, were to settle himself in one of the rich vales, not far removed from the navigable course of the Hunter's River, I know of no country in the world more calculated, as regards climate and situation, for human enjoyment."—Page 390.

Here it will be seen, that *capital* is absolutely neceessary to give the emigrant a fair chance of success; indeed, it could hardly be otherwise. We are aware that Mr. Horton proposes to maintain the settler for some time after his landing, although we are afraid his estimates for the purpose would turn out in practice to be as much below the actual cost as is usually the case with theorists; and, if they are to be thus maintained, and to be supplied with capital besides, why not attempt to do something for the labourers in their native country, by which at least the expense of passage would be saved, and they would be at hand to defend it in the hour of need, instead of (perhaps) adding to the number of its assailants? Of this plan, it will have been seen, Mr. Dawson, after all his experience in a new country, is a decided advocate—so decided, indeed, and so warm a one, that we are afraid his anticipations of its benefits are as much too sanguine as those of the friends of emigration. It can surely, however, be of no harm to make an attempt at home colonization; and it is certain that it would not be half so expensive as the transporting system.

While there are *any* recoverable parts of the mother country lying waste, or any means of employment at home left untried, it does seem absurd to ship off our able labourers to cultivate land and find employment at a distance. The fact seems to be, that although a removal of some of our working population to a country where land is cheaper, or labourers scarce, may do much good, the introduction of machinery must, sooner or later, compel some considerable alterations in the system of society, by which the wealth it produces shall be distributed more equally—otherwise emigration on emigration must take place until England is left a mere desert of capitalists and steam-engines; and even then, the capitalists and steam-engines may follow, and reduce the population of Australia, or Canada, to the state that the people of England are now in. What, in fact, are the advantages of emigration, but that it removes the labourer from the competition with machinery, which, at home, deprives him of his wages, while he still finds it impossible to live without food or clothing? When Australia becomes more densely populated, by which time machinery will probably be still more improved, what will then become of its inhabitants? Are they to compete with one another for the good of some overgrown capitalist, or will they have a government wise enough to impose taxes *in proportion* to income, and to take every means of *distributing* the wealth of the country, as well as encouraging its *production?* Or will *they* transport their poor to some now undiscovered paradise, on the recommendation of some yet unborn Wilmot Horton?

But we are forgetting the book before us; "the *present* state of Australia," a subject on which the public mind, as the author well observes, requires to be set right; for, as Mr. Dawson says,—

"There is perhaps no country in the world that has been so highly eulogised, and so much misrepresented. Interested motives have prompted many to say more in its praise than it has deserved; others, who had little or no practical knowledge of agriculture, or from want of information on those points which could alone enable them to convey just notions of the country and its means of production, have misrepresented its capabilities; while a third party, possessing the requisite knowledge, and a desire honestly to impart it, have failed to secure attention amidst the extravagant and romantic ideas which have prevailed upon the subject. The recent precipitate emigration to Swan River by all classes of persons, many of whom are not in the least degree qualified to grapple with the difficulties they must inevitably experience, is a practical illustration of the delusive notions now existing upon the subject of New South Wales. The adventurers have gone out with such feelings, and under such extraordinary circumstances, as would almost justify the belief that their imaginations had pictured to them a land actually flowing with milk and honey, and yielding its fruits without labour."—P. xi.

The latest accounts from Swan River are rather favourable, but altogether the scheme was deeply disgraceful to our government. It *may* turn out successful, but that is no palliation of the culpability of sending out ship-loads of infatuated beings to a shore with which government were totally unacquainted, and which, for aught they could, or even can now tell, may be, at certain seasons, as prejudicial to the health of Europeans as Sierra Leone, or Fernando Po!

After all we have said, we must confess that Mr. Dawson's work is not the book we expected it to be, nor such a one as the public had a right to expect. Its contents do not bear out its title. The extracts we have made, it will have been perceived, are either from the very end, or the very beginning of the book; for, in fact, the middle part is almost exclusively occupied with anecdotes of the natives, their manners and customs, and the freaks they played on some excursions which Mr. D. took into the interior. Some of these are amusing enough in their way, but the palate is apt to feel irritated when, in its search after "solid pudding," it finds only carraway-comfits—in other words, the reader, who has made up his mind for very interesting and very novel information on the subject of Australia, and the prospects it holds out to the settler, is vastly disappointed at being presented with a few funny stories of the pranks of the poor aboriginals of the country. As our notice would be incomplete without a specimen of these, we have quoted an anecdote which proves that man is every where the same—that every where, when "clothed in a little brief authority," he delights to wield it against his fellows.

"They are excessively fond of any part of the dress of white people. Sometimes I see them with an old hat on, sometimes with a pair of old shoes, or only one; frequently with an old jacket and hat, without trousers, or, in short, with any garment, or piece of garment, they can get. You may imagine how much laughter is excited amongst us, at times, by these grotesque-looking figures.

"One of the highest honours that can be conferred on them is to make them constables, and to give them a staff. That the honour may not be too cheap, I have made only two. They never appear but with their staves of office under their arms; and it is beyond measure ridiculous to observe the consequence they assume amongst their own people.

"Hear a conversation which one of my sable policemen, alias '*black guard*,' held with me some time since. 'Massa, 'pose black pellow crammer (steal), den I ketch it, you know. Pose dat go in bush; I look out; I find it; I bring it back; I murry cooler (angry); I gib it waddy (club), and put it in watch-house, you know; I make it know what he 'bout; dat no crammer 'gain, massa; bael I like anoder black pellow. I tit down (stay) here always; dis my place; you my massa, you know; I make black pellow work; I make it work; he no gammon me, massa.'

"Soon after this harangue, the Doctor was going from our camp to the village, which is called by its native name, Carrabean. It was nearly dark, and Mr. Heppie, the black constable (for that is his name), called out, in a thundering voice—'Who come dare?'—'A friend,' was the answer.—'O! murry goot,' says Mr. Heppie; 'pose dat black pellow, I taid, dable, what he do dare? why for he leabe black camp when dark? Tit (sit) down. Den I put it in watch-house, you know, and take it, massa, when urokah (sun) jump up.' 'That is very right, Heppie,' was the answer, with a hearty laugh at the end of it."—Page 75.

A few such short stories as these no one would object to; but we are sorry to say that they compose the staple of the work, to the exclusion of the useful information with which we had hoped to find it stored. A rapid sketch of the principal districts of the colony, their peculiarities, and capabilities, is indeed given in a sort of appendix; but even this is destitute of a single map, plan, or other illustration—a deficiency which is too great to be lightly passed over. For all purposes of reference, indeed, Wentworth's New South Wales still remains the best work on the subject. The long account of the method of rearing Merino sheep might have given place with advantage to tables of the prices of the various articles of food and clothing in the colony, which we were highly surprised at not being able to find in the work.

We have said that a "removal of some of our working population" would be calculated to be productive of good. If the following table of the prices of labour, and the necessaries, and some of the luxuries of life in Australia (which we have drawn from another source than Mr. Dawson's book) be correct, this position is incontrovertible; but it says nothing in favour of wholesale transportation. The *Sydney Gazette*, of May 29, 1830, asserts that this table has been drawn up with great care and attention. The prices are, on a yearly average:—

> "Meat.—Beef per lb., 1*d.* to 2*d.* Mutton, 1½*d.* to 3*d.* Pork, 5*d.* to 6*d.* Veal, 4*d.* to 6*d.* Ham (English) 2*s.* to 2*s.* 6*d.* Colonial, 1*s.* to 1*s.* 3*d.*—Fish per lb. 2*d.* to 4*d.*—Bread, finest wheaten, per loaf of 2lb. 4*d.* to 5*d.*; second, 2½*d.* to 3*d.*—Rice per lb. 2½*d.* to 3*d.*—Spirits, rum, best Jamaica, per gallon, 8*s.* 4*d.* to 10*s.* 6*d.* Gin, best Schiedam, 13*s.* 6*d.* Colonial 10*s.*—Tea, per lb., 2*s.* to 2*s.* 4*d.*; by the chest, 1*s.* 6*d.* Coffee, per lb., 1*s.* to 1*s.* 9*d.*—Clothing and haberdashery, about 25 per cent above English prices. Colonial-made boots, 40*s.*; shoes, 12*s.* Furniture, cheaper than in England.—Wages, carpenter, per day, 7*s.* to 9*s.*; bricklayer, and mason, 7*s.* to 9*s.*; shoemaker, 12*s.*; day labourer, 3*s.* 6*d.* to 4*s.*"

STEAM SHIPS OF WAR.*

Impressed with the importance of having steam men-of-war, our neighbours, (the French) as early as 1820, sent two officers to America to ascertain and report upon the properties of the celebrated steam-vessels of that country. They were Captain Mongéry of the Navy, and M. Marestier of the Corps of Marine Engineers. Both accounts have been published by the French Government, and in speaking of the labours of M. Marestier, the Members of the Institute say, "they do honour to the corps which produced such an engineer, as well as to the Naval Administration which employed him."

The Minister of Marine, in his Report which prefaces the printed Budget of 1830, announces—

> "That the arrangements necessary to the transformation of the cannon-foundry of the Island of Indret, on the Loire, into an establishment for the supply of engines for the use of the steam-ship dock-yard at that place, were not commenced till the end of 1828. However, notwithstanding the delays occasioned by a severe winter, it is presumed that the works will be sufficiently advanced for them to be in active operation by the beginning of 1830."

This steam dock-yard has already fitted out one vessel, *Le Pelican.* She had four wheels and four engines, of 60-horse power; the length 153 feet. The machine was made at Indret, and the engineers who directed it belonged to the establishment. Two steam-frigates are now building at this place, the *Castor* and *Crocodile.* They are sister ships: length on deck, 161 English feet; keel, 150; extreme breadth on deck (where the timbers in the fore and after parts curve outwards to cover the wheel, which is amidships), 36 feet, 4 inches; breadth amidships, 25 feet; and calculated to draw about 12 feet water. They will be armed according to a Ministerial dispatch of the 25th of February, 1830, which orders that steam-frigates of from 120 to 200 horse-power and upwards, are to be armed with six 24-pounder carronades, and three of Paixhans' new guns, carrying a hollow shell shot, and having a 12-inch bore. The weight of this gun is inferior to that of a long 32-pounder.

Last May, the keels of three other steam-ships were being laid down at Indret—the *Chimère*, *Salamandre*, and *Vautour*, of the same dimensions as those described above. In short, the French had nine armed steam-ships afloat, and nine were constructing in 1830, that is, their steam navy already consists of eighteen ships. When we consider this fact; when we consider the powers of the steam-ship, that she may, almost under all circumstances, escape from a sailing-vessel, and may have it in her power, as in the instance of a calm, to destroy a three-decker; when we hear Captains in the Navy avow, that at the breaking out of a war, they would sooner command a cruising steam-ship than the favoured *Endymion*—it is really surprising—melancholy—to find that there is not one steam man-of-war on our Navy List. That although a house has been finished some time, the construction of engines has not even commenced in our dockyards! Can it be believed that a nation which claims the honour of the invention, should be so stupidly behindhand in its most important application?

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* From the United Service Journal for March, 1831.

A steam-frigate should have an establishment as novel as its wondrous engine. Supposing her of 900 or 1000 tons burden, a captain should command her with four lieutenants; the office of master, as at present constituted, being much better performed by lieutenants, with a proportion of midshipmen and warrant-officers. 140 men would be sufficient to manage her simple sails, and man two powerful boats and two swift galleys. She should be armed with four of General Miller's bomb-cannon, two long 24-pounders, and four 68-pound carronades; in all ten guns. A draft of twelve feet water would be quite sufficient. As many of the portions of the engine as possible, with the boilers, should be situated below the surface of the water; the boilers ought to be many, at least six or eight, with a means of stopping the communication, as fitted by the French, to prevent an accident occurring to one, affecting the whole engine. Those parts unavoidably exposed, as the paddle-boxes, should be defended by a barricade, or covering of felt or cotton, sufficiently thick to destroy the effect of a shot, and covered with patent waterproof coating and tarpaulin to defend it from the weather. Colonel Paixhans, moreover, recommends fortifying the bow with plates of iron. With the power of making from ten to twelve miles an hour, with all the capabilities enumerated, and shot-proof, who would not be proud to earn his laurels and make his fortune in such a splendid vessel?

The command of the smaller steamers should devolve on commanders or lieutenants, according to circumstances. They would be disposable for general purposes, for the service of the sea-ports, for carrying mails and dispatches, to attend fleets and line-of-battle ships, and occasionally to look after privateers.

SAXULA'S THEORY OF LOCOMOTION.

Sir,—It is now several months since your correspondent, Saxula, promised that he would shortly give us a full explanation of the "new science of locomotion," of which he "claims the discovery," and which is to show, among other things, how the famous "wheelbarrow problem," about which he has since been puzzling your readers, is to be performed. How is it that he is so slow in the performance of his promise? Is he in no fear of some one being beforehand with him in revealing the grand secret? I observe there is a certain John Henry Clive, Esq. of Chell House, Staffordshire, who has recently taken out a patent for a discovery in locomotion* which promises results exceedingly like, and quite as surprising as, those of Saxula. "I can wheel myself," were Saxula's words, "up the steepest road in a common wheelbarrow" — "My little Triumph, by steam-power alone, performed the wheelbarrow problem as far as a rise of six or seven inches in the yard." Let only so and so be done, says Mr. Clive, the patentee, and the wheel will at once go forward, "*whatever be its weight*, OR WHATEVER BE THE ASCENT *under about twelve inches in the yard.*" (Register of Arts, for February, 1831.) Must not Saxula tremble when he reads this for his claim of priority? Here is a gentleman who has already obtained a patent for doing all that Saxula professes to do! Nay, who has already specified all about the manner of doing it, and (apparently) left Saxula nothing to reveal!! You have only, says Mr. Clive, to make the radius of the crank by which rotation is produced a little longer than usual, and the business is done. It has been customary hitherto to apply the motive-power to a crank not extending beyond the fulcrum or point of resistance; and this it is, according to Mr. Clive, which has "caused all locomotive-machines to fail in surmounting steep ascents or bad roads;" but let the crank to which the power is applied reach *beyond* the fulcrum or point of resistance, and, according to the same patent authority, "the wheel will at once go round, whatever the weight," &c. The fact may be so; I know too little of mechanics to presume to suggest a doubt on the subject—but this I will say, that if Mr. Clive is right, then all who have ever concerned themselves with locomotive-machinery (excepting always our friend Saxula and the said Mr. Clive) have been prodigious blunderers not to discover so simple a truth before. I should like much to know what Saxula thinks of this Mr. Clive and his discovery, and whether it is really by the same or by any different method that his "little Triumph" has achieved such wonders.

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* The patent is for "certain improvements in the construction of, and machinery for, locomotive ploughs, harrows, and other machines and carriages." Sealed 1st July, 1830. Specification enrolled 29th Dec. 1830.

Yours, &c. Telum.

P. S.—What if, after all, Saxula and John Henry Clive, Esq. should prove to be one and the same person!

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SELF-MOVING MACHINERY — REPLY TO MR. BADDELEY — BY ED. VOCIS RATIONIS.

Sir,—Your correspondent, Mr. Baddeley, in No. 390, page 383, says, "The first *error* into which the author of The Voice of Reason falls, arises from a misconception of the construction and action of overshot water-wheels," which he (Mr. B.) says are "propelled by the gravitating influence or weight of the water contained in the *buckets* on its circumference, and *not* by the impulsive force or momentum of a stream of water falling from a height and striking the float-boards of a wheel." What! Mr. B., *not* propelled by the impulsive force or momentum! Has the water momentum? Yes. Then, what does it do with it? Oh, it imparts it to the wheel, the stricken body. I have had a wheel of this description at work for years close to my dwelling, and so can have no "*mis*conception of its *construction* and *action*." It acts in this way: when the men shut down, as it is termed, or the water is stopped—the wheel having gained a velocity—revolves for a few seconds, sufficiently to discharge the water from its buckets. If then this wheel, standing as it does with empty buckets, be not propelled by the momentum of the stream, how could it be *instantly* again propelled—which it begins to be the *moment* the water is let on—the first bucket which it strikes being the only one filled? Again, suppose the wheel had no buckets to contain the water but flat boards, after the manner of an undershot, would not the *momentum* of the same stream, impinging against its upper circumference in the direction of a tangent, turn it the same as if that force were applied to any other part of its circumference in the direction of a tangent, even the under part? It would; therefore an overshot wheel *is* propelled by the momentum of the stream. The buckets are merely an economy of power in aid of the more active momentum of the stream, and *contribute* by their gravity to the motion of the wheel, having previously transferred their *momentum* to it. If this will not suffice, to call in the *momentum* of the Fall of Niagara, or a water-spout from the clouds, would be ineffectual.

The next error which Mr. B. points out, he says, is contained in the following extract:—"It is the pressure of the atmosphere upon the surface of the fluid in the vessel which causes it to rise and flow through the syphon; and it is the pressure of the air added to the weight of water in my vessel which impels it with such force through the orifice at the bottom of it." In this Mr. B. thinks he has made a discovery, which he supposes I was not aware of; viz. "that the atmosphere presses equally in every direction." Well, we know it does; but is not that resistance which it opposes at the area of the orifice, *overcome* by the resistance of the fluid from within the vessel? Certainly the water will escape, in spite of it, with vehement velocity; hence this pressure of the air on the area of the external orifice is overcome by something within the vessel, viz. by the pressure of the air upon the surface, added to the weight of water in the vessel; for if the pressure of the air were removed from the surface of the fluid in the vessel, the water with all its gravity would not readily flow even through an orifice near the bottom. Of this, a canary-bird's fountain, or a vessel without a wind-peg, will suffice as an example. If, then, the stubborn water will not flow by its gravity from the canary-bird's fountain, what is it which would make it flow? Why, admit the air through a small perforation at the top, and then the water will run out every drop—consequently, it is the air which causes this effect.

Again, respecting the syphon, Mr. B. says, "the atmosphere presses equally in every direction, and consequently on each end of the syphon." Granted—for if the air did *not* press at *the one* end as well as at the other, it *would not* be the air which caused the water to rise to the top of the syphon: but, then, in order to produce that *effect*, the pressure of the air is hindered from the orifice of the long leg, by placing the finger on it, and sucking the air out of the syphon by a small tube attached to it—so that the pressure of the air on the surface of the fluid forces the water through the orifice of the short leg into the vacuum; therefore, in this case also it *is* the pressure of the air which does it.

Investigations like the present, say what Mr. B. will, and superciliously as he may be pleased to treat them, are not without advantage. You see the Pumpmaker (No. 390, p. 384) is on the look-out. I advise him to improve his pumps; the expressing-fountain is an improvement, and who knows what the next improvement may be. "Erroneous" as the plan of the "Ed. Vocis Rationis" is pronounced by some persons to be, it appears that he by no means stands alone in his delusion. "I tried the thing (says this Pumpmaker) many years before, and I have reason to think it has been tried by hundreds." Neither is it from any error in principle that the thing, which has been tried so often has failed; no, the principle is admitted to be correct, but the practical means of turning it to account have proved inefficient; our Pumpmaker's pumps would not carry water enough; all would have been right but for the imperfection of the pumps—here was the grand obstacle. Now I repeat—improve your pumps and hydraulic machines, so that they may be able with greater facility to carry water sufficient; for, if you do succeed, how will such machinery tend to cheapen the price of a loaf for the hungry, and provide useful and profitable *employment* for thousands of industrious mechanics, in numerous branches, to which such perpetual water-mills in every place might be most *economically* applied? No expense for coals, no filthy smoke, which now renders the atmosphere of manufacturing places unwholesome. The Pumpmaker should have considered that the great water-wheel to work the pumps is an *undershot*, and therefore has no "*boxes*," by which his calculations may be made; the quantity of motion or momentum on the wheel being measured by the velocity and quantity of the moving force *jointly*.

Yours, &c. ED. *Vocis Rationis*.*

Feb. 18, 1831.

NEWTON'S APPENDIX TO EUCLID'S "ELEMENTS."

Sir,—Some months ago a correspondent of yours (No. 362, p. 330) requested the aid of your learned readers in solving the following problem:—"Given the difference between the side and diagonal of a square, to construct it." The solution must be entirely deduced from the first 23 propositions of book i. of Euclid's "Elements." Your correspondent mentioned the work in which he found the problem—"Appendix to 'Euclid's Elements,' by J. Newton." The *name* induced me to procure a copy of this work; it is good enough in its way, but reminds one that every Newton is not *the Newton*.

Well, to come to the point, I beg to inform your correspondent, that if he has mastered the 6th proposition of this Mr. Newton, he will meet with no difficulty in the 23rd. The 6th is as follows:—"Half the difference of the base angles of a triangle is subtended by the difference of the sides containing the vertical angle;" that is, "if from the greater base angle a straight line be drawn to the opposite side, making with the base an angle equal to half the difference of the base angles of the triangle, the segment of the side towards the base is equal to the difference of the sides containing the vertical angle."

Now, this theorem is intended to be demonstrated by the first six propositions of Euclid only; and, for my own part, I honestly confess I cannot see how it is possible. I think you will admit with me, that it comes in prematurely, even *if practicable*. It is premature, 1st. because it speaks of the difference or half difference of angles; and, 2nd. because it assumes that the greater side is opposite the greater angle; and I might even add that it deprives Euclid's 32nd proposition of a very pretty and natural deduction.

Perhaps some of your scientific readers will give a demonstration of the 6th proposition of Mr. Newton *as he intended it*, i. e. by the first six propositions of

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* The work alluded to is not the political pamphlet to which the Ed. M. M. refers, but a theological work in defence of the Christian faith against the Age of Reason. It was with satisfaction I observed, some time since, the laudable efforts of the Ed. M. M. to prevent the theatre of the Mechanics' Institution being converted into an arena for the propagation of infidel opinions; and I shall be happy to present him with a copy of the above-named work for the use of such Members of that Institution as cannot afford to purchase.† I think every person whose real interest and happiness we have at heart will do well to read it before they die.—ED. *V. R.*

† It had better be sent at once to the Library of the Institution.—ED. M. M.

Euclid, *and no more.* Perhaps the Rev. Author himself (for so, I believe, he is) will condescend to do so, or your correspondent to whom I have already alluded.

Yours, &c. SAMUEL SIMPLE.

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SAFETY OF STEAM-BOILERS.

By a Royal Ordinance in France, of March 27, 1830, it is decreed that every boiler employed in public works or manufactories, where steam is equal to two atmospheres and over, shall have

1. Two safety-valves of equal dimensions, and each of sufficient size to discharge the steam freely in case of its too great tension.
2. Each valve shall be loaded by *direct* pressure, and without the intervention of a lever, with a weight equivalent, at most, to one atmosphere.
3. Near one of the valves on the top of the boiler, there shall be adapted a metallic plug, fusible at the temperature of 127° centrigrade (=260.6° Fahr.). This plug shall be of such a diameter that its free surface shall be four times as great as that of one of the safety valves.
4. One of the valves and the fusible plug shall be locked up under the same grated enclosure, and the key shall remain in the hands of the principal of the establishment. The other valve shall be under the direction of the engineer of the machine.
5. Each boiler shall be furnished with a manometer open to the air, the glass tube of which shall terminate at the height of twenty-eight inches (French) above the level of the mercurial surface pressed by the vapour.

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NEW PATENTS.

Brief Notices of Specifications, Enrolled in 1831.

SELF-RELIEVING HOOKS, *Jeffrey Shores, Blackwall, Boat-builder, Patentee.*—An iron strap is fastened to each side of the block and pulley-frame, and extends a few inches below it; the hook turns freely on a pivot placed between the lower extremities of these straps; and the stem of the hook is made so much heavier than the claw, that as soon as any weight attached to it is removed, the stem falls back and the claw is liberated from the ring, or eye, which it occupied. *Date of Patent, Nov.* 1, 1830*; of Specification, Jan.* 1, 1831.

IMPROVEMENT IN LOOMS, *John Harvey Sadler, of Praed-street, Paddington, Patentee*—Includes, first, a method of applying the oscillations of a pendulum, to the working, by one man, of two looms; and second, a method of actuating the looms by the rotation of a shaft. *Date of Pat., July* 1, 1830*; of Spec., Jan.* 1, 1831.

IMPROVEMENT IN WHEEL-CARRIAGES, *Aug. W. Gillett, of Birmingham, Merchant, Patentee. Improvement communicated by a Foreigner, residing abroad*—Consists of a wheel within a wheel, or a method of making every wheel carry its own railway. The Editor of the Register of Arts observes, with as much truth as smartness, of this invention—"we really thought that it had long ago been wheeled out of the catalogue of useful inventions; years back it was fairly wheeled out of England, but it appears to have floated over to America, where, being picked up by Jonathan, he regards it as the wheel of fortune—posts over to England, and sells, as a grand and original discovery, to John Bull himself his own rejected wares." *Date of Pat., Nov.* 4, 1830; *of Spec., Jan.* 3, 1831.

IMPROVEMENT IN MACHINERY FOR DYEING HATS, *John Bowler, of Southwark, Patentee*—Consists in making the dipping-frame, on which the hats are suspended, revolve on pivots, so that at every quarter, or half revolution of the frame, a different part of each hat shall be upwards when raised from the kettle to dry, and thus a greater equality in the dyeing be obtained. *Date of Pat., Nov.* 4, 1830; *of Spec., Jan.* 3, 1831.

NEW SHEATHING FOR SHIPS, *Mathew Uzzieli, of Clifton-street, Finsbury-sq. Gent., Patentee.*—The new sheathing is to consist of 100 parts of copper, and from 5 to 7 parts of tin; and the plates are to be first annealed and then passed some twelve or fifteen times through laminating rollers, till they lose their crystalline appearance on being fractured. Plates thus compounded and prepared are stated to be much less oxidizable than the ordinary copper sheathing. *Date of Pat., Jan.* 6, 1830; *of Spec., Jan.* 6- 1831.

INDEPENDENT SAFETY-BOAT, *W. Dobree, Fulham, Gent., Patentee*—Consists in rendering the boat buoyant by air-tight copper tubes. The same thing was proposed by a Mr. Watson, about a year ago, and by many others before him. *Date of Pat., Aug.* 5, 1830; *of Spec., Jan.* 8, 1831.

IMPROVEMENT IN PROPELLING VESSELS, *Thomas Bulkeley, M. D., Patentee.*—The object of this improvement is to enable the crew of a ship to propel it by the application of their manual power to the capstan, when the sails are rendered useless by calms or otherwise. The capstan turns on an axis, on which is fixed a drum, round which drum an endless chain or band passes, to actuate a pair of spur wheels that communicate motion to a pair of pinions, on the axis of a set of paddle-wheels. These paddle-wheels are so constructed that they may be detached and taken to pieces when not in use. *Date of Pat., July* 19, 1830; *of Spec., Jan.* 19, 1831.

(To be regularly continued.)

EMERY CLOTH.

There is an immense consumption of sand paper and of emery paper, both in private families for cleaning furniture and utensils of iron and steel, and still greater in manufactories of hardware of all descriptions. But paper is so brittle that it will not hold together after having been used a little while, and, unfortunately, this happens just when its quality as a polisher is the best, from the coarser grains of sand or emery having been rubbed off. By substituting the cheapest kind of calico for paper, an article has been produced, the durability and utility of which far more than compensate the additional cost. The inventor is a Mr. T. Lowthorp. The sand, pounded glass, and emery, are to be sorted by washing over in the usual way, and then are to be dried for use. The calico best suited for this purpose should be thirty-two inches wide, of a strong even thread, but not too coarse, and which has been as little dressed as possible. It is to be put into stretching frames two yards long, and, after being wetted with warm size, is to be stretched to a width of thirty-six inches. The size employed for this purpose is composed of 2lbs. of good glue, dissolved in six quarts of warm water, and then mixed with two quarts of water that has previously been boiled with half an ounce of alum, and six ounces of good wheaten flour. The mixture is to be put over the fire in any convenient vessel, and, when it begins to bubble, is to be poured out into a pan for use. On the dry calico, still in the frame and stiff with the coating of size, is to be laid on another coat of a stronger size, made by dissolving 4lbs. of glue in three quarts of warm water, and adding one pint of the first size, together with an ounce of gum arabic, and an ounce of gum tragacanth. While this strong size is yet wet, the emery, sand, or glass-powder, is to be sifted on as evenly as possible, and the calico is again set to dry, and is afterwards brushed, to remove the loose particles; a second coating of strong size is then to be laid on, and is to be covered with another layer of sifted emery, &c. It is then again to be dried and brushed, and is now ready to be removed from the frame, and cut up into sheets for sale or for use.

MISCELLANEOUS.

Diving-Bell Accident.—The other day, while two men were down in a diving-bell, executing some repairs on the piers of Westminster Bridge, the pipe suddenly burst. One of the men, knowing his danger, immediately slipped from under the bell, swam to the surface, and escaped. The bell was then drawn up, and the other workman taken out in a senseless state, but after a short time he was happily recovered.

New Cause of Explosion in Coal Mines.—Mr. Buddle has sent to the Natural History Society of Newcastle, an account of a singular phenomenon occurring in the east drift of Jarrow Colliery, where it was found that, as the workmen proceeded, powerful eructations took place when the coal was struck by the pick. These were as loud as the report of a musket, and by their force, large splinters of coal were thrown off, much to the alarm and annoyance of the workmen. Mr. B. suggests that a late accident may be attributed to an eruption of this nature, but of much greater magnitude.

Vacuum Engine.—A few weeks ago an engine of a new construction was put into operation for the purpose of draining Soham Meer in the Fen district. The principle of the machine is the formation of a vacuum in a cylinder by the combustion of hydrogen gas, and forcing water into this vacuum by means of atmospheric pressure. It is said to be capable of being worked at two-thirds of the expense of a steam-engine.—*Monthly Review, for March.*

Dr. Wollaston had a very extraordinary facility of modifying sounds to his ear, so as to increase or lessen them to almost any degree; this he effected by the peculiar exertion of a pair of muscles connected with the tube of the ear.—*Ibid.*

Foreign Competition.—" A carver," in a letter to the *Times*, states, " for the information of the liberal and patriotic subscribers to the fund for the restoration of York Minster, that a very large proportion of the new carved ornaments for the stalls, screen, &c., have been carved by Dutch and Flemish carvers, while scores of our own countrymen (clever, competent workmen) are walking the streets without employment." The reason assigned, is "cheapness, not want of talent, the pattern being made in England and sent abroad to be multiplied." [It would require a stronger case than is here made out to convince us that there is any thing to blame in the conduct of the managers of the restoration in question. Mr. "Carver" wishes it to be believed that while there are "scores" of "clever, competent workmen walking our streets without employment," it is found cheaper to send the patterns abroad to be multiplied—spite of all the expense of carriage to and fro, agency, duties, &c. than to employ any of those idle, street-walking workmen to do the work. The thing is incredible—Mr. "Carver's" statement refutes itself. He is evidently some disappointed would-be contractor.—Ed. M. M.]

Oil of Sweet Almonds is often adulterated with oil of poppy seeds. When you suspect this to be the case, agitate the oil in a phial, when, if there has been any such intermixture, bubbles will attach themselves to the sides; a circumstance which does not occur when the oil is pure.—*American Journal of Science.*

Hard Work.—The ore from which the copper of the Hartz mountains is extracted is so excessively compact and hard, as even to defy gunpowder. The following extract from a proces-verbal drawn up in 1808, will give some idea of the obstacles which the miners of this district have to contend with:—"A workman was employed 88 hours in boring a hole 4 inches deep; during this time 201 boring-augers were rehardened, 26 were remounted with steel, and 126 were entirely destroyed."

What Mules think of Railway Conveyance.—The produce of the Maunch Chink Coal (anthracite) Mine, in Pennsylvania, is conveyed to a village of the same name in waggons, running on an inclined railway; and to each train of 42 waggons there are 7 cars attached containing 28 mules, which are employed to draw back the waggons when emptied. Professor Silliman states, that the mules readily perform the duty of drawing up the empty waggons, but that "having once experienced the comfort of riding down, they appear to regard it as a right, and neither mild nor severe measures, not even the sharpest whipping, can ever induce them to descend in any other way."

Seamen Exempted from Stone.—In an elaborate and able essay upon Calculus, by Mr. A. C. Hutchinson, contained in a recent volume of the Medico-Chirurgical Transactions, we are furnished with a piece of novel and interesting information. Mr. Hutchinson proves that stone, gravel, gout, scrofula, and cutaneous diseases, (all of which he considers to be allied, inasmuch as they all occur in the same diathesis) seldom or never afflict seafaring people; he shows, by official documents from the Naval Medical Board, and from surgeons of sea-port hospitals, that during the last thirteen years not a single case of stone or gravel has occurred in the navy, among an annual average of 25,000 seamen employed, and that only *one* case in a merchant seaman has been received in the sea-port hospitals during the above periods out of a floating maritime population of about 183,000, although 760 operations for the stone had been performed within the same period in these sea-port hospitals on other individuals. Mr. Hutchinson also shows that stone has been more prevalent in Scotland than in England during the last ten years, there being only one case, in an average of about 83,000 of the population of the former country, while, according to Dr. Yelloly, there has been one case in an average of every 108,000 of the population of the latter.

Pursuit of Knowledge under Difficulties.—Mr. Editor, I have been much pleased and indeed instructed, by the sensible observations which you have from time to time made, in your valuable periodical, upon various publications relating to science and the acquisition of general knowledge. I fully coincide with you in your judgment respecting that volume of the Library of Entertaining Knowledge upon the pursuit of knowledge under difficulties. I am myself a practical illustration of its useful tendency, for having relaxed from a rule, which I had laid down for myself, of rising at six o'clock every morning, by delaying an hour beyond that time, I had no sooner read the first number of that delightful volume, than I recurred to my old rule, and trust that I shall never again deviate from it. The second volume is, as you say, much inferior to its precursor, being extremely languid, and wanting the spirit-stirring energy of the former. I was much disappointed to observe the omission of the famous Rousseau, as an example to encourage the poor, unfriended, and plodding lover of knowledge; his unwearied efforts to acquire a beautiful style of composition—his incessant toil to gain a perfect knowledge of music—are instances of perseverance that are worthy to be recorded with similar qualities in Heyne, Hunter, Hutton, or Ferguson. I might mention many other foreign names, superior to several of the Englishmen which are recorded in the volume; this I consider a defect—for surely the work is not meant merely for *Englishmen*, but for *men in general;* and I trust that its useful pages will be translated into the languages of all Europe, to arouse the dormant energies of the listless, the pennyless, and solitary, who languish with the thirst for knowledge, yet despair under the idea that its sources are to be reached by those only who have money and time fully at their command. I hope we shall have no more such minute works as those upon insect-architecture and insect-transformation, which should have been condensed within half their present bulk; such volumes are not of a nature to instruct the general reader—they are more suited to the microscopic philosopher, scrutinising for principles in the multitude of facts. Permit me to suggest a work, much wanted, in a complete and cheap form, and one which would come into the scope of the Library of Useful Knowledge; I mean a number or two devoted to the explanation of the use of instruments, such as sectors, rules, sextants, globes, &c; as those now extant are expensive, and they include scarcely any modern inventions.—Believe me, with sincere and grateful respect, your constant reader,

T. L. D.

[We approve highly of the suggestion with which our correspondent concludes, and recommend it to the consideration of the Useful Knowledge Society.—Ed. M. M.]

INTERIM NOTICES.

A. B. T. in our next.

Eli's communication is very clever, but not at all suited to our pages.

Mr. S. H. will find a letter at the Post Office, Manchester.

Communications received from Mr. Henderson—A Subscriber—Mr. Lea—Mr. Baddeley—U. U. C.—C. B——k—T. S.—A New Subscriber—Delta—B. C. S.—A Journeyman Mechanic—A Member of the Society of Arts—A Friend.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

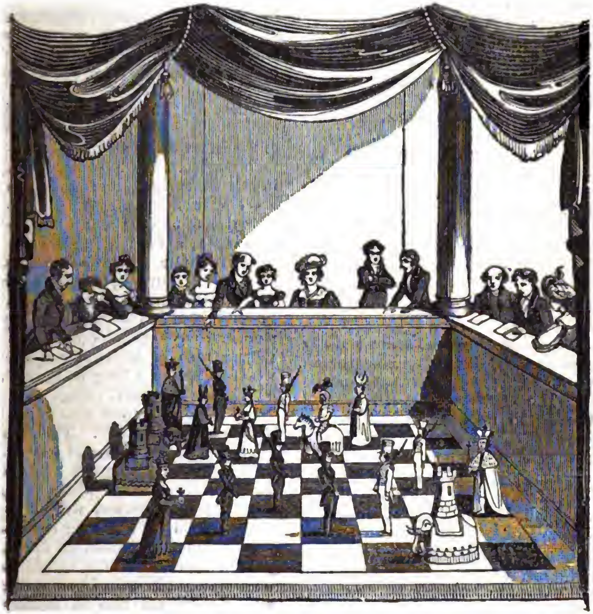
Mechanics' Magazine,

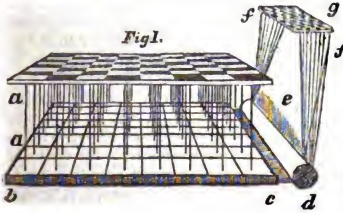
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 396.] SATURDAY, MARCH 12, 1831. [Price 3*d.*

Strange and unnatural ! let us stay and see
This pageant of a Prodigy ;
Lo ! of themselves, the enlivened chessmen move.—Cowley.

LIVING CHESS PLAYERS.

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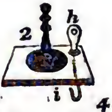
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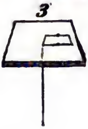
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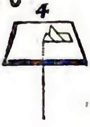
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A SCHEME FOR PLAYING CHESS, SUITABLE TO PUBLIC EXHIBITIONS.

Sir,—The early history of chess is involved in much uncertainty—some authors wishing to make it appear of greater antiquity than is allowed by others. Dr. Hyde* has traced it as an invention of the Hindoos, many years before Christ; most writers concur in the same opinion. However, in his Historical Disquisition on Chess, the Hon. Daines Barrington maintains that it originated with the Chinese. It is stated, on the authority of a Chinese MS., that one Hemsing, commander of a Chinese army, 379 years after the time of Confucius, taught his men the game for the express purpose of reconciling them to the perilous situation in which they happened to be at the time, in which, it is added, he fully succeeded. If tradition may be relied on, chess was intended as "an image of war," and as such we find it to have been made use of by Pyrrhus, who was in the habit of forming and communicating his designs for the order of battle by the results of chess men.

Chess has been cultivated in every civilized country; our ancestors appear to have been very partial to this game before cards became the fashion; many English families having emblazoned on their arms chess-boards, and also chess-rooks. The Game of Chess, published by Caxton, in 1474, has many curious particulars on this head; among other facts it is mentioned as a fashionable amusement in most houses of rank in the time of Richard III. Than chess few games have been spoken of in more laudatory terms, nor has praise on any other been more deservedly bestowed. It requires the greatest possible address to play it well, as success is by no means dependant on chance; it has no connection with gaming; it has been played by popes, emperors, kings, princes, with costly figures of gold, silver, or ivory, and the poor Indian has played it with different-coloured pebbles; it is a delightful relaxation for the learned, and not less so for the illiterate, and has been very properly styled "a *gymnasium* of the mind."

Twiss, in his work on chess, quotes the following from Dr. Hyde, where he says, "Don John, of Austria, had a chamber in which was a chequered pavement of black and white marble; upon this living men moved under his direction, according to the laws of chess."

"The same thing is told of a Duke of Weimar, who, in squares of black and white marble, played at chess with real soldiers."

About 1783 the celebrated Automaton Chess-player, dressed in a Turkish costume, was exhibited in London. The history of this curious production is well known, especially one singular quality, entitling it to an epithet made use of by Dryden, for it was, in reality, an "unchekmated man."

These are two of the most striking instances which the history of chess affords of the game being played out of the common routine. We have here living men in lieu of images, and an image in the place of a living player. It is now my intention to proceed with a brief account of a scheme for playing this noble and scientific game with an animated dramatis personæ, but in a manner much similar to a pantomime, and suitable for public exhibition. It differs from any other plan that has been adopted, in this, that though men or boys be employed, the whole game may be gone through without breaking silence, except to proclaim "check," or otherwise distracting the attention of an assembly. That it is possible to place persons dressed in appropriate costume on a chequered plain, and inform them when and where to move by a mechanical process, will, I hope, be evident from the following description of the machinery intended for this purpose.

In the centre of the exhibition room let a platform be raised two or three feet, and marked out into 64 squares; this will serve for the chess-board on which the actors will have to perform their several parts according to the rules of chess. The engraving represents this platform, or stage, in its complete state, and the game pretty far advanced. Underneath are shown, fig. 1, a perspective view of the chequered stage, with (*aa*) 64 wires descending from the centre of each square to the same situation in corresponding ones on the board, *b*, *c*, underneath. These wires are then drawn towards the end, *c*, of the lower board, and passing below the long roller, *d*, which may be grooved, or have small pins to keep the wires in order, they rise up, as at *ff*, to the small chess-board, *g*, each wire from the large squares touching a corresponding square on this smaller board. This last arrangement is necessary, because the movements of the actors will have to be regulated by those of the player or players at the board, *g*. The wires running along the side of the roller *d* at *e* (48 in number) are purposely not drawn to their proper length, to prevent a confusion of lines in so small a figure; it was thought sufficient to define only the wires at the extremities of *g*. The roller *d* serves to ease the action of the wires, as well as to keep them from being entangled.

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* Author of a very elaborate treatise, entitled De Ludis Orientalibus, by the Rev. Dr. Thomas Hyde, 1694; reprinted at Oxford, 1767.

Fig. 2 is an enlarged view of a single square of the board *g* (fig. 1), having a pawn placed on it, and at *h*, the head of a long-shanked hook, *i*, which will explain the manner of fixing the wires. The 64 squares of *g* being formed in a like manner, it is intended, on moving the piece, which in the present case would be a pawn, *h* must be pulled up by the hand, which will give notice to the actor representing that pawn in the exhibition room, that he will soon have to perform the same thing. The game, in other respects, played on this board, will be after the usual manner with common chess men. The wires attached to the several hooks, *i*, of the board *g* are made to act upon a small trap-door in each square of the stage. Fig. 3 represents one of these closed, and fig. 4, the same, as when opened by way of signal; to keep them from doing so of themselves, they ought to have a small spring or weight. Now, a stage properly fitted up in this way might be neatly covered with a fine carpet, having the squares printed on it; this would not make it the less perceptible to the actor when to move, nor more difficult to observe the square for which the player at the board *g* (fig. 1) might destine him. When the actor has to move to an occupied square, he is to know it, not by seeing the trap-door, but by the actions of the occupant of that square. For example: when the black know it is their turn to move, and, we will suppose, a pawn receives the signal by the movement of the trap-door against his foot, how is he to know, provided he finds he is not to advance, and the square on each side of him has an adversary, which of these two he is to attack? Why, one of them (the white) will have received a signal at his foot, and knowing it is not the white's turn to move, and aware he is to be attacked, prepares as if he would defend himself—this is quite enough for the pawn, the attack immediately follows, and he takes possession of the square. It is first to be understood that each man must keep as quiet as possible; that the right foot be placed lightly over the trap-door, and that the moves be made deliberately. Retrograde, and all other movements, may be ascertained by fixing the number of beats on the foot to be given by the trap-door (figs. 3 and 4). It cannot be necessary to say more on the dresses than that complete scarlet and white uniforms would be the most appropriate, and that, as regards the castles and knights, their horses and elephants might be fashioned of strong pasteboard, with drapery hung round the body in such a manner as to hide the men's feet; the castles having small windows in front, the actor would, through them, have a clear view of the stage. Professors of the game, or the examples given in chess books, might be employed in playing the games in the ante-room, where the small chess-board, *g*, would be kept.

This scheme would afford an agreeable means for our chess clubs to exercise their skill to the entertainment of themselves and their friends. And more instruction might likewise be obtained from seeing such games as are laid down by Philidor and others played in this manner, than on the common board, where the study must needs be as confined as it is tedious.

Among the curiosities of chess, some of the principal ones have been glanced at, but the "game of chesse play" does not appear ever to have been applied as here proposed. To all true admirers of this princely exercise it would, I feel persuaded, be no less gratifying to them than to the writer to *see* this exhibition

> "Of armies on the chequer'd field array'd,
> And guiltless war in pleasing form display'd."

Yours, &c. HENRY D——.

Liverpool, February, 1831.

GILDING (INQUIRY ANSWERED)—WRITING IN GOLD.

Sir,—In reply to the inquiry of M. P., at page 447 of your last volume, I would observe, that he has not stated whether the *composition* to which he alludes is used for gilding the edges of books or the leather. For gilding the edges of books and paper, some workmen use glaire, others prefer parchment size, and sometimes a composition formed of four parts Armenian bole, and one of candied sugar, ground together with water to a proper consistence, and laid on by a brush with the white of an egg.

For lettering and gilding on leather, glairing is most frequently the only preparation that is resorted to; sometimes, however, very finely powdered yellow resin, or gum mastich, is dusted over the leather; upon the hot tools or letters being applied, the gum or resin melts and securely fixes the gold leaf to the leather in the parts which have been touched by the tool.

As your correspondent wishes to know the method of gilding on silk, I have extracted the following from Nicholson's Operative Mechanic, as being likely to answer his purpose:—

> "To gild silk, satin, ivory, &c. by hydrogen gas:—Immerse a piece of white satin, silk, or ivory, &c. in a solution of nitro-muriate of gold, in the proportion of one part of the nitro-muriate to three of distilled water. While the substance to be gilded is still wet, immerse it in a jar of hydrogen gas, and it will soon be covered with a complete coat of gold. This experiment may be very prettily and advantageously varied, as follows:—Paint flowers, or other ornaments, with a very fine camel-hair pencil, dipped in the above mentioned dilute solution of gold, on pieces of silk, satin, &c. and hold these over a Florence flask, from which hydrogen gas is evolved during the decomposition of the water by sulphuric acid and iron filings. The painted flowers, &c. in a few minutes will shine with all the splendour of the finest gold. A coating of this kind will not tarnish on exposure to the air or in washing."

I cannot close this communication on the subject of gilding without laying before your readers the following easy and effectual method of writing in gold, invented by J. Hemming, Esq., one of the Vice-Presidents of the London Mechanics' Institution.

Take a small quantity of boiled linseed oil, to which add sulphuric æther until it is sufficiently fluid to flow freely from a common pen; with this composition write on paper, card, or any other similar substance, and cover the writing with leaf-gold; in a few minutes the æther will have evaporated, leaving a very thin film of oil behind, which will effectually secure the gold leaf to the paper or other substance, and the superfluous gold may be wiped off in the usual manner, when every stroke of the pen will appear gilt. From the rapidity with which æther evaporates, it is necessary to write but a little at a time—writing and gilding alternately, until the whole is completed.—Yours, &c.

WM. BADDELEY.

March 4, 1831.

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ADVANTAGES OF STEAM-VESSELS IN THE EVENT OF A WAR.*

In a late debate in the French Chamber of Deputies, Mr. Mauguin is reported, in speaking of the chances of war, to have said, "What nation will dare to attack us? Will it be England? With steam-boats we can carry arms and battalions into Ireland." The intimation thrown out, and the opinion expressed in this short sentence, are most important.

I have long felt that the question of the effect of the power of steam as applied to vessels, was one that required the utmost consideration on the part of those entrusted with the management of the naval affairs of this country, so as to be fully prepared to take the utmost advantage of it in the event of a war. I hope and believe that the present Government, in endeavouring to avoid a war, will be influenced by motives much more honourable and more consistent with the greatness of the country, (to wit, their sense of the vast importance it is of to the civilized world that peace should be maintained,) than those which Mr. Mauguin intimates will deter them; and moreover I trust and hope also, that such will be the measures in respect to Ireland, that if ever the French shall make the attempt Mr. Mauguin suggests, they will find the people rally round the standard of a patriot King and a fostering Government, and defeat them.

But as to the means that an enemy would have of attacking us by the agency of steam-boats in case of a war, I for one totally differ from Mr. Mauguin. I have always coincided with the opinion expressed by Lord Liverpool (I quote from recollection only), at the meeting held for the purpose of voting and paying some mark of respect to the memory of Mr. Watt, when his Lordship stated in effect, "that however powerful this country had been at sea, he considered that the application of steam to the navigation of vessels would render it still more powerful, inasmuch as that, from the superiority of our machinery, and from the facility with which all the requisites for fitting out steam-vessels were to be obtained in this country, we should much more readily be enabled to cover the sea with a larger number of steam-vessels, and those of better construction, than our enemies could possibly oppose to them."

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* From the United Service Journal for March.

Such, if I mistake not, was the purport of Lord Liverpool's observations, and, for one, I not only go entirely with his Lordship, but I even have thought, that if we have an energetic and able Board of Admiralty, (which I trust we have now and shall continue to have,) by proper measures being taken at the commencement of a war, the ports of an enemy may be so hermetically sealed by means of armed steam-boats, supported, if necessary, by other vessels of war, that our enemy may be totally prevented from ever fitting out any considerable number of steamers; for it must be recollected that most of the materials required can only be conveyed in any quantities coastwise to the ports of France; that there are few places where the machinery can be manufactured, and that coals are found in quantities only in the northern departments; and it must be recollected also, that steam-vessels blockading ports are not subject to the same danger that sailing-vessels are; they have no fear of a lee-shore, and they can constantly pull in under headlands, no matter how near, provided they are out of gun-shot, so as to find protection from most winds, and still by keeping one or two on the look-out, continue a most strict blockade. Under this impression it has ever struck me that it would be desirable, the instant a war should break out, that every steam-boat in the country that could bear the sea, and would carry a gun, should be taken up and armed, and that a proper number, supported, as I have before said, if necessary, by other vessels of war, should be as soon as possible dispatched, to prevent entirely the communication between the ports of France.

By proper precautions of this sort, even a fishing-boat would be unable to pass from one port to the other; and instead of Mr. Mauguin's threat being carried into effect, the whole of the French nation, as far as maritime intercourse goes, would be cut off from all communication with the other nations of the world; or even supposing the result may not meet my views to the fullest extent, it must, nevertheless, be obvious, that to a very great extent, (considering that at this moment there are, I understand, in this country, above fifty steam-boats that might be armed and sent to sea, and a large number of others which might be employed in the narrow part of the Channel,) the possibility of the French ever fitting out a number of steamers might be prevented; and so far, therefore, from not daring to go to war for fear of being attacked, in what Mr. Mauguin considers our vulnerable point, Ireland, it is France that should dread going to war, lest her naval and her commercial interests should be totally destroyed.

I confess it has often surprised me that the application of steam to navigation, and the very great changes it probably will make, in the event of a war, in naval tactics, has not attracted more attention, and occasioned more to be said and written on it. In the year 1797 or 8, I forget exactly which, I well remember seeing the *Swiftsure* and *Theseus*, two 74-gun ships, attacked in a calm in the Bay of Gibraltar, by some Spanish row-boats: they both suffered severely without, I believe, at all injuring their opponents; although at the time I heard it stated, that one of those vessels had fired away more powder than she had expended in some previous naval action—I think the 1st of June. Now, if a few such unwieldy boats as the Spanish gun-boats, that could not row four miles an hour, could place themselves so as to occasion such a loss to two line-of-battle ships, without injury to themselves, what may not be expected from steamers that can move at the rate of ten or eleven miles? It has always appeared to me, that as far as coals can be supplied with facility, fleets of steamers will invariably carry all before them. There are few circumstances under which they need be under any apprehension from sailing-vessels, for however fresh it may blow, they have only to pull away directly in the wind's eye, and get out of danger; in short, they can seldom be exposed but end on, and they will, of course, be armed with a gun, both in the bow and stern; and there will be little difficulty in making barricades to cover these guns, shot-proof, if necessary, as were the battering-ships at Gibraltar. There is, however, much, I am aware, to be attained to bring to perfection an armed steamer: the paddles must be protected, and some means must be devised to prevent the nicety of the machinery being damaged by the concussion from firing the guns; in short, it is not difficult to imagine that the war-steamers at the commencement, and those at the end of a war, will be very different vessels; and it is for this reason that I am desirous of drawing attention to the subject, in the hope that, by so doing, we may be prepared to commence a war with vessels, although not so perfect as further experience may render them, still, at least, superior to those of the enemy.

MILES.

February 3, 1831.

LONDON MECHANICS' INSTITUTION.

At the last quarterly meeting held, on Wednesday evening, the 2nd instant, it appeared that there was a considerable increase in the number of the members, and that the funds of the institution had also proportionally improved—several of the outstanding debts having been paid, and a portion of the standing debt liquidated. A proposition was made for the entire abrogation of that law of the institution, which provides that, at least two-thirds of the committee of management shall be of the working class — the avowed object of its supporters being to introduce a larger number of clerks, &c. into the direction. The motion was, however, very inefficiently advocated; one of the requisitionists, who said he was an engraver, made an oration in favour of the proposition, but consistently concluded by avowing his determination to vote against it! Mr. Garvey, a working man, and a very old member, and some others, showed with great ability the evil tendency of the proposed alteration; and it was finally rejected by an overwhelming majority.

On the usual vote of thanks being moved to the retiring portion of the committee, a long, stormy, and disorderly debate ensued, during which the president was repeatedly, and, as it appeared to us, most wantonly, interrupted in his exhortations to order and decorum. So pertinaciously was the vote opposed, that it was at length found necessary to adjourn the debate to Friday, the 4th inst. The discussion was then renewed and carried on much in the same strain. The opposition to the vote of thanks seemed to us to proceed from a small clicque, resolute on making as much mischief as they could, and more bent on the mere gratification of party spirit or sectarian views, than on promoting the good of the institution. A detailed account of the speeches would, therefore, be neither interesting nor profitable, and would only afford importance to a weak and factious party. Suffice it to say, that one member was candid enough to blame the committee for rejecting (as he asserted) lectures on political economy by Mr. Cobbett! It is to be hoped, that such another quarterly meeting will not soon occur. The behaviour of many to the president was most shameful and disgusting. Repeatedly interrupted in his endeavours to preserve order—rudely and pertinaciously contradicted by beardless boys — too much praise cannot be given to him for the admirable temper he displayed, for the impartiality of his decisions, and for the patience with which he endured the boisterous tempers of the speakers. The excellent example he set the meeting, will, it is trusted, be remembered by all of them; and, it is to be hoped, that hereafter, the proceedings of the London Mechanics' Institution will be as heretofore, distinguished for good conduct and good feeling.—Yours, &c.

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NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

GRAIN-SIFTING APPARATUS, *W. W. Tuxford, of Boston, Miller.*—An arrangement of spindles, cranks, &c., by which a rotary motion is given to a number of sieves at once; the actuating-power, water, wind, or steam. A new application of machinery, and likely to be extensively useful.—*Date of Pat. July* 6, 1830; *of Spec. Jan.* 6, 1831.

IMPROVED RECLINING-CHAIR, *George Minter, Upholsterer, Princes-street, Soho.*—One of a numerous family, and as good probably as any of them; but not distinguished by any peculiar novelty.—*Date of Pat. Nov.* 9, 1830; *of Spec. Jan.* 8, 1831.

IMPROVEMENTS IN STEAM-BOILERS AND FURNACES, *William Taylor, Wednesbury,* *Engineer.*—The *first* of the improvements claimed by Mr. Taylor consists of a mode of regulating the supply of water to the boiler—not very different from other methods we have seen proposed, and of very questionable efficacy; the *second* of a modification of Scott's invention for collecting and removing deposits, which, considering how perfectly the original apparatus acts, must be regarded as somewhat superfluous; the *third*, of a method, now discovered for the twentieth time, of consuming the smoke by drawing it from the chimney and forcing it through the fire; and the *fourth*, of another method, equally original, for effecting the same purpose, by making the smoke return and pass through a series of red-hot tubes within the fire.—*Date of Pat. July* 19, 1830; *of Spec. Jan.* 19, 1831.

LOCOMOTIVE STEAM-CARRIAGE, *John Rawe and John Boase, of Albany-street, Regent's-park.*—The principal novelties claimed by the patentees are, 1. A boiler formed of stout wrought-iron tubes, one-eighth of an inch asunder, bent into spiral figures, of three turns, and inclining downwards towards the furnace. 2. An exhausting-fan, to accelerate the current of air among the tubes, which is to be worked by a small steam-engine. And, 3. A blowing-apparatus, to be also worked by the aforesaid small steam-engine, which is to force a mixture of steam and heated air through the fire in order to promote combustion. Subordinate to these *prime novelties*, there is a multiplicity of minor arrangements, with which we do not deem it necessary to trouble our readers. Messrs. Rawe and Boase's patent is a sad hodge-podge of things old and new, combined with but little mechanical skill, and all claimed as their own by a very extraordinary stretch of fancy. We do not risk much in predicting, that no steam-carriage constructed in the manner set forth in their specification will ever grace the road; and still less in saying, that were they to succeed to their hearts' content, there would not be a feather in their caps which they could fairly call their own.—*Date of Pat. July* 19, 1830; *of Spec. Jan.* 19, 1831.

(*To be continued.*)

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STEAM-TRAVELLING ON COMMON ROADS.

Mr. Gurney appears to have, at length, so far overcome the *res adversæ* of steam-travelling on common roads, that a carriage of his construction is now actually plying twice a day on the level road between Gloucester and Cheltenham, a distance of ten miles. The first trial was successfully made on the 1st of February; the carriage commenced running regularly twice a day on the 21st of February; and in the *Cheltenham Chronicle* of the 1st of March, we find the following very satisfactory account of its subsequent performances:—

> "The steam-carriage commenced running between Cheltenham and Gloucester on Monday last, and has since continued to perform the journey regularly; starting punctually from the Commissioners' yard, Cheltenham, at ten and two o'clock, and leaving the Spread Eagle, Gloucester, at twelve and four. The carriage contains altogether twelve persons, and has been filled by passengers. All the persons who have travelled by it seem much pleased, and agree that the motion is remarkably smooth, regular, and agreeable. It runs the distance in about twenty minutes; and no accident has hitherto occurred of any description."

◆

SMITH'S PATENT CHIMNEYS—DESIGN FOR A CHIMNEY-TOP.

Sir,—In reply to the admission, conviction, supposition, satisfaction, and inquiry, of W. N. respecting Mr. Seth Smith's damper, allow me, through the same channel, to request he will make *ten* experiments before he draws such conclusions; for, I am convinced, and without a supposition, I am perfectly satisfied, that neither he, nor any other person, can predict in which of *ten* cases, if in any one, it will prove unsuccessful.

The merit of Mr. Smith's metallic chimney-lining is perhaps by very few properly understood. This may arise in some measure from too hasty an examination, or from not having had an opportunity of inspecting it.

Some imagine that because the flue is circular, it is the same in principle as all other circular flues. Others—and here perhaps I must include yourself—think, because the lining is of metal, that necessarily it must be the same as all other chimneys which may have been formed of metal, especially such as may have been circular and built in the heart of brick or stone walls; consequently, that Mr. S. has produced no improvement.

If this were the case, it would appear impossible for any person now to obtain a patent for any *improvement* (for example) in a pump or shower-bath, because pumps and shower-baths have been made and used time out of mind. The shape of particular pots, and the manner of uniting them so as to obtain the object required, cannot, if such be correct reasoning, entitle a person to a patent.

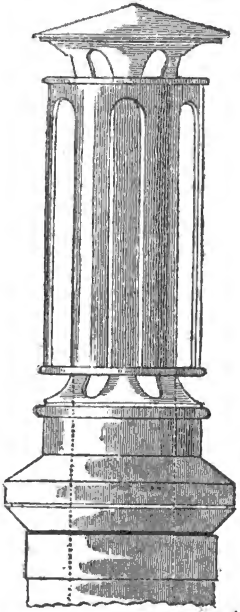
Now, I have always understood, although I do not profess to know much of the patent laws, that it is not for a principle, but the manner in which a principle is applied, that a person obtains a patent.

I further presume to suppose, that had any really useful method of constructing and applying a metallic lining to chimneys been hitherto known, its great importance being so obvious, and, as you will see by the subjoined list of prices, the cost being so very moderate,* such lining would, long ago, have been in general use. This, however, is not the case; I would therefore recommend a particular examination of any chimney supposed to have been thus constructed, and let it be compared with Mr. Smith's.

To satisfy, if possible, W. N., and not to occupy your columns without an endeavour to add some information for your readers, I herewith send you a sketch for a chimney top, which I have designed for Mr. Smith's tubes, and which, I presume, will be found to answer for every situation.

Fig. 1 is the plan, and fig. 2, the elevation, including a small portion of the brick or stone-work into which the lining is introduced, and to which this chimney top is fixed.

The inner tube of the chimney top is of the same diameter as the lining, and it has six longitudinal slits, or openings, at equal distances from each other; each opening is equal in area to the horizontal section of the flue, which determines their length. The top of the inner tube is covered.



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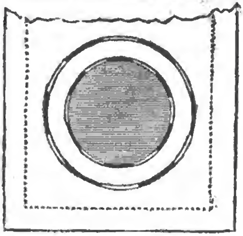


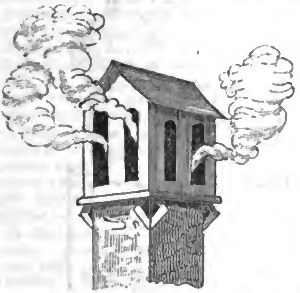
1

* Bore of Tubes.	5 in.		6 in.		7 in.		8 in.		9 in.		10 in.		
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	
Straight Tubes	1	8	2	0	2	5	2	10	3	4	4	0	Per foot, run
Curved Tubes......	2	1	2	6	3	0	3	7	4	3	5	0	Ditto ditto
Starting Rings......		10	1	0	1	3	1	6	1	9	2	0	Each
Starting Tubes ...	1	9	2	0	2	6	3	0	3	8	4	6	Ditto
Damper													Ditto

The outer tube has also six longitudinal openings, and this is so fixed by radiating rods to the inner tube, that the openings in the one may be before the closed poots of the other. The space between the tubes is equal in breadth to the slits in the inner tube, and this space is open both at top and bottom.

Now, I think it must appear evident that, from whatever quarter the wind may blow, however it may whirl, or however the chimney-top may be situated, it will have a greater tendency to assist the escape of the smoke than to retard it; and any rain or snow driven between the tubes will fall out at the bottom.*

Openings in the sides of a chimney-top are, however, not a new invention, for in some of, perhaps, the oldest engravings of views in the east, such opening may be seen. Sometimes they look like embrasures in a turret. The top of such a chimney is invariably covered. It is thought a chimney like the following sketch may be found in the library of the Royal Academy (*Vasi Vedute di Roma*),



L. 4. 1. Perhaps not knowing that such chimneys have been used, may have occasioned some persons to think that the word translated *chimney* (Hosea, xiii. 3.) should have been rendered *lattice*. It is not however impossible but that lattice might have been used in such chimney-tops to prevent birds building their nests there.

Is it not a very great disgrace to architects, and, indeed, to the proprietors of houses, especially those of a classical character, to suffer them to be disfigured by the unsightly objects every where to be seen on the chimney-tops?

The principle of the design here proposed may be much varied, and doubtless more elegant effects produced.

Although I have admitted that openings in the sides of a chimney-top are not new, yet the accompanying sketch differs so much from the original idea, and from any thing else that I have seen, as would, I presume, entitle it to a patent.

So much for the chimney-top. *I hope, however, soon to show*, that in consequence of the reduction of brick-work, when Mr. Smith's lining is introduced, that a great improvement may be made in the appearance and comfort of an English fireside.—Yours, &c.

JOSEPH JOPLING.

24, Somerset-street, Portman-square,
March 1, 1831.

◆

DRUMMOND'S IMPROVEMENT IN LIGHT-HOUSES.

(Abridged from a Communication by Lieut. Drummond to the Royal Society.)

The more rude and ancient methods of illuminating light-houses with open coal fires, with common lamps or candles, sometimes aided by reflectors, composed of small facettes or plane mirrors, have, in this country, been completely superseded, even in light-houses of secondary importance: and it may be said, that there is only one method now in use, for this purpose, along the coast of Great Britain and Ireland. This consists in the use of a parabolic reflector, of about three or four inches focal length, and from twenty-one to thirty inches in diameter, illuminated by an Argand lamp, seven-eighths of an inch in diameter, placed in the focus. The reflector is hammered out of a plane surface, consisting of two plates of silver and copper rolled out together, and though executed with great skill, considering the means, cannot be regarded as a very perfect instrument.

In fixed lights, the number of these reflectors varies according to the portion of the circumference required to be illuminated: but it should not be less than this arc divided by the angle of divergence of the reflected light. At the Eddystone, where the whole circle requires to be illuminated, the number should not be less than $\frac{360}{17}=21$: if it be less than this, there must be dark spaces, diverging from the light-house as a centre, in which nothing but the unassisted light of a single Argand will be visible.

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* I would just observe by the way, having the diagrams exhibiting the "*motion of the fluids*" before me, that by carefully observing the motion of the flakes of snow, the motion of the air about the top of any smoky chimney might perhaps be correctly ascertained.

In revolving lights, there are five, seven, and even ten reflectors on a side, the number of sides being usually three or four. In the light-houses lately erected on Beachy Head, and on the Perch Rock at the mouth of the river Mersey, there are thirty reflectors in each, disposed on three sides, each bearing ten reflectors. These are the latest, and may be considered as the best specimens of this method of illumination; being about ten times more powerful than the ordinary fixed lights. In some few instances oil gas has been introduced, but the intensity of the flame being very little, if at all, superior to an Argand lamp supplied with the best spermaceti oil, little or no advantage can be expected from this introduction, as far as regards the brilliancy of the light, when reflectors are used.

About thirty-eight years ago the experiment was tried, in three or four light-houses, of substituting glass lenses instead of metallic parabolic reflectors. These lenses were twenty inches in diameter, of nineteen inches focal length, and about five inches thick: but from the imperfection of form, and the badness of material, the light transmitted by them appears, by our late experiments, to be about one-third of that of the reflectors now in use, while their divergence is so small, that one-third of a degree on each side of the axis they cease to be visible. With a view probably to remedy these defects, a somewhat extraordinary arrangement was adopted, viz.—the addition of parabolic reflectors behind the lenses. It is true that by this means some addition is made to the direct light of the glens, and, what is of more consequence, the divergent light is increased; so that, at an angle of about three degrees with the axis, it is equal to about thirteen times the light of an Argand. So far, therefore, the reflector, though but a small portion of it comes into use, contributes to the effect of the lens; but the converse experiment does not appear to have been tried, viz.—how far the reflector was improved by the lens being placed before it: otherwise it would quickly have been perceived that the effect of the reflector alone was about double the united effects of the reflector and lens; while at the same time, its effective divergence was also greater, being about eight times that of the combined lens and reflector, at an angle of three degrees on either side of the axis.

This plan was, fortunately, never very extensively adopted: and in those light-houses belonging to the Trinity House, where it was tried, it has subsequently been discontinued, and the lenses replaced by reflectors. The North Foreland, however, under the management of the Governors of Greenwich Hospital, still remains a solitary example of a method which cannot be too soon abandoned, more especially since the remedy seems so easy,—merely to remove the lenses, and leave a free and unobstructed passage to the light of the reflectors.

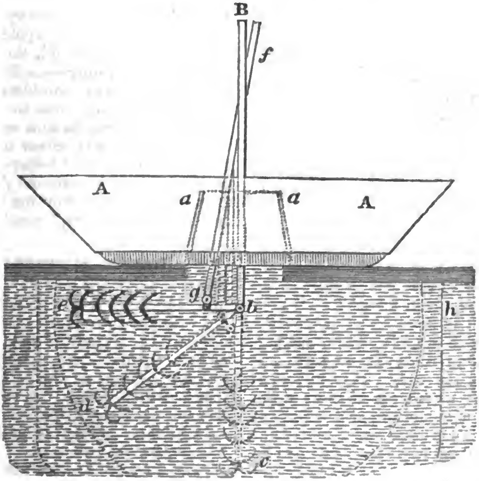
Another mode, differing from these now described, has lately been introduced into France by MM. Arago and Fresnel, which rivals the most powerful of our lights in brilliancy, and surpasses them in economy and facility of management. A large Argand lamp, with four concentric wicks, the exterior of which is three and one-third inches in diameter, occupies the centre of the light-house.—Around this powerful light, eight magnificent lenses, thirty inches square, are disposed, touching each other at the edges, and forming a hollow octagonal prism about the lamp. Above these, smaller lenses of a similar construction, but in the form of trapezoids, are placed, inclining towards the centre, till their axes form angles of about fifty degrees with the horizon, at which inclination their sides come into contact, and thus completely inclose the central light. By the intervention of plane mirrors, the beams of light issuing from the secondary lenses, are rendered parallel to those of the principal; but, by the same means, a horizontal deviation of about seven degrees is given to them, so that this addition to the light is made to contribute to the divergence and consequent duration of light when revolving, rather than to add to its brilliancy. The lens, which is plano-convex, is of a peculiar construction, being formed of separate rings or zones, whose convex surfaces preserve nearly the same curvature, as if they constituted portions of one complete lens, the interior and useless part of the glass being removed; so that a section of these zones resembles a wedge placed with the edge uppermost, one side—that next the lamp, being a straight line, the other an arc of a circle.

The idea of such a lens appears first to have occurred to the celebrated Buffon, when engaged in some experiments on burning-glasses; but he supposed, what is not possible, that it might be ground out of one large piece of glass. Dr. Brewster, in an article on the same subject, in the Edinburgh Encyclopædia, in

1811, showed that it might be built of separate pieces; and this was an important step, inasmuch as it rendered of easy execution, what was before impracticable. To Dr. Brewster, therefore, the priority of suggesting this improvement is due. To MM. Arago and Fresnel, obviously unacquainted with what had been previously done or recommended, belong the praise of having first got such a lens constructed, of combining it with a very powerful lamp, and above all, of giving it a most useful and beneficial practical application.

A mode of illumination is now recommended by Lieutenant Drummond, very different from any of those, and, to all appearances, decidedly superior. He proposes to derive the light from a ball or cylinder of *lime*, intensely ignited. He had already used this sort of light for purposes of survey, and, on such occasions, the intense heat was communicated by directing a stream of oxygen through a flame of alcohol. But the use of alcohol, on such a large scale as a light-house would require, must necessarily be very expensive. Lieutenant Drummond has therefore proposed to substitute for it hydrogen gas, which answers the purpose in the most satisfactory manner. He has, accordingly, contrived an apparatus, by which the oxygen and hydrogen gas shall pass through separate avenues, until they approach the ball or cylinder of lime; near that point the gases mingle, and the united stream poured upon the ball keeps it in a permanent state of intense ignition. The invention was recently tried at the Trinity-house; and the astonishing result was obtained, that the light emitted by a lime-ball, only three-eighths of an inch in diameter, heated by two jets of the compound gas, is equal to that sent forth by thirteen Argand lamps. The expense of this light, provided with all the advantages which it is capable of receiving, will not exceed two shillings and sixpence an hour.

GREGORY'S SKATER'S LIFE-BOAT.



Sir,—The return of the winter season, with its accompanying amusements and disasters, re-called to my recollection a very ingenious skater's life-boat, which was exhibited three or four winters back by Mr. John Gregory, well known to the public as the constructor of some ten or fifteen different fire-escapes, several of which have been described in your former volumes.

Considerable difficulty and frequent failures having occurred in attempting to recover persons from beneath the ice with a boat and drag-hooks of the usual form, an arrangement suggested itself to Mr. Gregory, of which the above rough sketch will serve to give your readers a tolerably correct idea.

AA represents a sledge-boat, having a well, *aa*, in its centre. B is a compound drag, in which the principal merit of the invention consists; this drag is jointed at *b*, which admits of its traversing up and down through the arc *c*, *d*, *e*, in addition to its circular horizontal motion. Its motion is directed and regulated by the lever *f*, which is jointed to it at *g*.

A person having fallen into the water in consequence of the ice breaking, the boat is to be drawn over the hole by means of ropes, &c. The compound drag is then put down through the well in the boat, and made to traverse the whole of the space included within the dotted lines, *hh*; and although the unfortunate individual may not rise exactly in the spot where the ice is broken, yet it is hardly probable that he will be so far removed from it as to be out of the reach of this very effective drag. In using the common straight pole drag, from a boat drawn towards the edge of the hole in the ice, it frequently happens that the person rises but a short distance from the hole, and yet in a situation entirely out of the reach of succour, from the slanting direction which a straight drag is necessarily made to assume under such disadvantageous circumstances.

Should the ice be so much broken as to permit the boat to be launched, the compound drag may be used in the well, or from either of the ends or sides of the boat, with the greatest facility. If used from the well in the centre, the boat will be less liable to upset in getting the person into it than when the weight is acting on one of the sides. This drag combines all the usefulness of those of the usual form with unexampled facility of application, and other more important advantages than have been obtained by any other contrivance. As inventions of this useful character cannot be too publicly known, perhaps you will, at an early opportunity, appropriate a corner of your Magazine for this description; in doing which you will promote the cause of humanity, and oblige, yours, &c.

WM. BADDELEY.

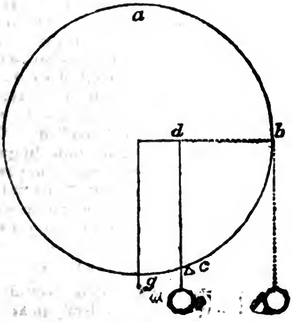
THE WHEEL-BARROW PROBLEM—SAXULA AND HIS LOCOMOTIVE THEORY.

Sir,—The problem propounded by Saxula, in No. 378, of wheeling oneself up a steep hill, has not met with much attention from your correspondents notwithstanding his having announced it "to be the germ of a surprising growth in the powers of locomotive machines." The only solution which has appeared, agreeing with Saxula's own, is that given by me in No. 385. I will not say that this inattention has arisen from incredulity, as to the correctness of "the new and unknown theory of locomotion which Saxula has investigated," and to the discovery of which he invited the attention of your readers; but I certainly did venture to intimate, that the subject was too simple to admit of any new light being thrown on it, and even presumed to express my fears, that if the principle which my solution of Saxula's problem exemplified, was the "leading principle" of his new locomotive science, it would *lead* to no useful result. As I had not the good fortune to discover Saxula's "new and unknown theory of locomotion," I could not grapple with unknown errors, and could, therefore, only assign for such unreasonable doubts and fears, some negative considerations, which it is not necessary here to repeat. To these observations, Saxula replied in No. 388, that "I was either unwilling or unable—the latter he believed—to prove his problem by experiment;" and "that I knew very little about the matter, and less about the theory," concluding with the quotation,

> "Off with his head! so much for Buckingham."

The felicity of this quotation is certainly to be admired—it is so perfectly in keeping with the spirit of his remarks; to be despotic in argument and opinion, is quite congenial with despotism in authority. Saxula is right in supposing that I was unwilling "to prove his problem by experiment;" for, being convinced that the thing was practicable, I thought it needless to give myself the trouble. However complimentary his remarks, I should have let them pass unnoticed—for I hate controversy for the sake of controversy, even in self-defence, unless something useful can be elicited in the course of it; and therefore I have never replied to any observations bestowed on my communications to your

Magazine—I say, I should have let this subject drop, had not my attention been attracted to a letter which appeared in the Register of Arts, for February last, from John Henry Clive, of Chell-house, in the county of Stafford, Esq., in which he alludes to some improvements in locomotive machines which he had lately patented, and particularly explains and enforces "a grand principle of the theory of locomotion, a theory that (he believes) has never yet been correctly explained." I shall not greatly err, I imagine, if I assume that this gentleman and Saxula are one and the same person.* The secret, therefore, which was to pose your readers, is disclosed; and, as we have now something tangible to deal with, and a useful object in view, I feel less reluctance to resume the subject in dispute. It is proper, however, that Saxula should first explain and defend his newly-discovered and patent principle, in his own words, and with the aid of his own diagram.



"Let *ab* be a locomotive-carriage wheel: let *c* be a stone or acclivity of a hill. Of course the wheel must be lifted over the peak of this obstacle before it can go forward. Then let *d* be a crank or pin in the wheel, to which the motive power is applied. This power, when carried by the wheel, acts not like the draught of a horse, but only in the direction *de* (you must please to allow this as a fact, unless you can plainly prove it erroneous, as on it one grand principle of the theory of locomotive action depends—a theory that, I believe, has never yet been correctly explained). I presume you will at once admit that no force in the direction *de* can propel the wheel over *c*. It may turn it round, twist out the spokes, or grind it into the earth, but over *c* it can never go; because *c* becomes a fulcrum, and the power is on the same side the fulcrum as the weight, and acting in the same direction; but let the power be removed beyond the fulcrum towards *b*, acting in the direction *bf*, and the wheel will at once go forward, whatever be its weight, or whatever be the ascent, under about twelve inches at a yard (that depending on certain other circumstances), provided the power and leverage be, as in other machines, proportioned to the weight. Not knowing, or overlooking this simple principle, has caused all the locomotive machines to fail in surmounting steep ascents, or bad roads, when their momentum was exhausted."

I shall now endeavour to explain, in as familiar a way as possible, the manner in which Saxula appears to have been misled in his views of this subject. In his wheelbarrow problem he has confounded power and resistance with each other, and imposed upon himself by a verbal deception. He did *not*, as he says in No. 388, "trundle *himself*, and the machine *that carried him*, up an inclined plane, &c." but by his weight—which was the power, he trundled, not himself, but the empty barrow behind him, which was the resistance. Instead of employing the force of his muscles to push the barrow before him, he employed the force of his own gravity upon the wheel, in order to drag it after him. *That's all.* To talk of being *carried*, in this case, is certainly a very Irish mode of expression; and reminds one of the story of Pat, who was *carried* in a sedan-chair, with the bottom out. Saxula saw, that the result of the power which he exerted in this occasion was in the downward direction of his weight; and not sufficiently distinguishing this from mere muscular force, he transfers the idea to locomotive-machines, and imagines that their power acts only in the direction *de*. He appears also to consider this power to be of the nature of gravity, and to have no abutment for re-action. But his principal error lies in mistaking the situation of the fulcrum, and in overlooking the fact that the fulcrum is movable in this case. He says that it is situated at *c*, but it is not. Let him consider what is done in the rowing of a boat, and having determined that the fulcrum is, in this instance, at the edge of the boat, and not in the water, he will be no longer at a loss to find it in his own case. But it will be well to explain the subject with a little more attention to particulars.

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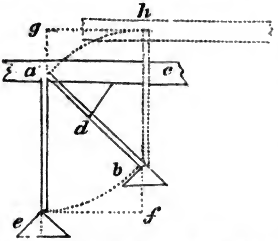
* A similar conjecture was thrown out by another correspondent in our last number. We hope the real Saxula will speedily set all doubts on the subject at rest.—Ed. M. M.



Let the wheel of a carriage, then, be reduced to the simple case of a single lever *ab*, whose fulcrum is at *a* (the centre of the wheel), which, with the frame *ac*, is supposed to be immovable. Let a power be applied to the lever *ab* at the point *d*, with a view to overcome the resistance, or remove the obstacle at *b*, and having for its abutment the immovable frame, *ac*. It is clear that the lever *ab* may be made to take the position *ae*, and the obstacle be removed to *e*; having been forced downwards the distance *bf*, and horizontally backwards the distance *fe*. Let us now suppose the fulcrum, *a* with the frame *ac*, to be movable, and the obstacle *b* to be immovable, and it will be equally clear that the relative position of things, on the application of sufficient power, must be the same as before. The lever and its fulcrum *a* will again become perpendicular to the obstacle *b*, but the latter being fixed, the former will be removed to *h*, having been forced upwards the distance, *ag*, and horizontally forwards the distance *gh*. The fulcrum and the power will go on together. According to Saxula, no such result can be obtained. If he should still be unconvinced, let him put two or three slips of wood together, peg them to a table, and try it. The reader will perceive, in the above diagram, something similar to the action of the legs of quadrupeds. According to Saxula's theory, no animal could ascend a hill. It is very strange that so many of our locomotionists should have imagined that they could obtain any thing by the use of legs or propellers which they have not already got in wheels. Mr. Gurney soon abandoned them—indeed he appears to have been employed on nothing else for several years but in proving, by expensive experiments, the futility of his successive contrivances; and which might have been easily foreseen and avoided by any person possessed of a little mechanical tact. Let Saxula take heed, and not purchase experience at too dear a rate. B. C.

AMERICAN MANUFACTURES.

The Americans, like our neighbours the French and Dutch, and like some peddling patriots among ourselves, have thought to stimulate the growth of their domestic manufactures by Annual Exhibitions, but apparently with not much better success. We have now before us the Report of the Committee of the Franklin Institute on the sixth of these exhibitions. Of *thirty-seven* premiums which were offered for the year 1830, *three* only have been adjudged to be due. The first is for a stock, or standing vice, which is pronounced to be equal in quality to the best imported, and in design even superior—"the screw of the box being cut out of the solid, while in the English vices the thread of the box is brazed in." The second is for a cooking-stove, adapted to the burning of anthracite (different from that of Vinton's, described in our 384th Number), approved of on account of its cheapness (thirteen dollars), but described as liable to this serious objection, "that the objects intended to be cooked are exposed to the gases resulting from the combustion of the coal." The third is for a new vegetable oil, extracted from sunflowers—said to be "not fit for the uses of the table, unless by persons who prefer a very sapid oil;" but as it is of a highly siccative nature, well adapted to painting, and "applicable in many other cases as a substitute for olive oil." But though the committee have not considered any of the other premiums offered to be "strictly due," they have selected eight individuals from the host of unsuccessful competitors, as deserving of the distinction of silver medals, for their ingenuity and perseverance in particular branches of art. One had proved himself a good manufacturer of stone-ware; another of lino, and other such fancy stuffs; a third had made an "interesting display of American silk, in all its conditions, from the cocoon to the most perfect manufacture;" a fourth had exhibited an elegant looking-glass; a fifth, a pianoforte of his own making, but not remarkable; either "for the excellence of the instrument, or the beauty of the workmanship;" a sixth, some mother of pearl work; a seventh, a magnificent chandelier; and an eighth, some pieces of ash and maple veneers, produced by a new machine of his invention, by which the veneers are cut out in one continuous sheet.[*] The committee conclude their report by the following sensible and candid observations "upon the general character of the goods they exhibited."

"Experience has shown that those goods are the most popular, and are held to be in best taste, which are the plainest and the neatest. It is more by the elegance of their forms, by the chasteness and appropriateness of their ornaments, and by the simplicity and uniformity of their colours, that taste is displayed and admiration secured. As to those works in which gaudiness takes the place of neatness, in which all the colours of the rainbow are brought together, and of which uncouth carvings, heavy mouldings, and overloaded gildings, are the chief recommendations, although they may please an immature and an unimproved taste, they cannot, and experience shows that they do not, find favour with a discerning public. This observation applies to cabinet ware; to pianos; to porcelain; to glass ware; to marble mantel pieces; to all kinds of architectural works; to coal grates, &c., and as far as colours are concerned, to printed cotton and silk goods, &c. We take pleasure in stating that the manufactures of this country are daily becoming less liable to censure on this score. Another point in which we observe great improvement, since the first exhibitions of the Institute, is in the general finish of the articles; formerly, while those parts which were intended to be prominent were overloaded with meretricious ornaments, coarsely finished and unskilfully applied, the rest were left in the rudest condition; now the whole of it approaches more to that finished style of elegance which so peculiarly distinguishes the productions of England. To this point we would chiefly invite the attention of our manufacturers; although much has been attained, still something remains to be done."

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CORK WADDING.

Sir,—About three years ago I had occasion to order some corks to be cut, which should be perfectly cylindrical and of equal size. I find that such corks, cut into slices of about half an inch thick, make the *very best* wadding between the powder and shot. In order to ensure their equality in size and shape, I took two brass buttons of the precise diameter, and cutting off the shanks, I inserted in their place sharp pins, of about a quarter of an inch long. One of these buttons being stuck upon each end of the parallelopipedons of cork, the cork-cutter had only to run his knife once round them, to produce cylinders, all equal, smooth, and regular, and in *much less than half* the time which, without the assistance of the buttons, was expended in cutting other corks, all various in calibre, facetted, and irregular. When it is desired to cut corks of a more or less conical shape, it will only be necessary to use two buttons of different sizes. The buttons may, if thought preferable, have two or three points to them instead of only one,=Yours, &c.

FRANCIS MACERONE.

February 1, 1831.

◆

MINOR CORRESPONDENCE.

Barton's Pistons.—Sir, I addressed a letter to you (which I perceive you have acknowledged in your notices to correspondents) last week, complaining of an insidious attempt to prejudice me, professionally, through the columns of the *Glasgow Herald*—a Paper of considerable circulation and respectability—with reference to my metallic pistons, and also of the conduct of the Editor of that Journal in refusing to insert my reply, unless I paid for it as an advertisement, the provocation having been given and the injury having been done to me by that very Paper. I now beg leave, however, to withdraw my communication to you, as after a private remonstrance to the Editor of the *Glasgow Herald*, I find by his Paper, received this day, that he has in his last Number published my letter, though in the shape of an advertisement. My wish is to disclaim having sent it as an advertisement, or having paid for it as such. Your insertion of this may and will prevent any misapprehension on this matter among my friends in Scotland, where I know your Magazine is extensively circulated.—I am, Sir, your obliged, **John Barton**, No. 6, *Goswell-road, Feb.* 28, 1831.

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[*] This is really a very ingenious and useful improvement. We extract the following account of it from the Franklin Journal; the inventor is a Mr. Caleb Burnap. The log to be sawed is fixed so that it may be made to revolve on centres like a piece of wood to be turned on the lathe, and in this situation is actually turned so as to become truly cylindrical. Circular saws, running upon the ends of mandrils, are placed in a row, with their faces in one plane, and their peripheries nearly touching, so as to cut the cylindrical log longitudinally and tangentially. A traversing motion is given either to the log or to the frame upon which the saws are placed sufficient to unite the cuts of the respective saws in one horizontal line.

Mathematics.—"A Constant Reader" wishes to know how he may best acquire a general knowledge of mathematics. We recommend to him to study Dr. Gregory's Mathematics for Practical Men; there is no better guide.

Water-proof Coating.—Sir, In No. 394, p. 457, you quote an instance of the successful application of a water-proof coating on the South Stack Lighthouse. I have some knowledge of a coating for similar purposes, and for flat roofs (respecting which much has been said in your useful pages) it is superior to any thing I have seen described. An old slated roof of mine, which would scarcely hold together, was coated with it last year, and cost little more than twopence per square yard. It has stood the winter, may bid defiance to wind or rain for some time to come without further repairs, and is, in fact, firm as a new roof. If the lighthouse you refer to had been done with *one single coat*, with or *without* sand, the next tide might have beat against it without any effect. Any gentleman signifying a wish, through your publication, to avail himself of it, shall be furnished with further particulars, by **An Original Subscriber**, *Liverpool, March* 3, 1831.

[We know more than one individual who would be much obliged by the communication of some "further particulars."—Ed. M. M.]

Steam-Carriages.—Sir, Allow me to offer, through the medium of your miscellany, to the notice of any of your numerous readers who are speculating in the manufacturing of steam-carriages for our common roads, a small model of one on a new principle. Perhaps it will not be amiss to mention that it has never yet been shown to any person of the class to whom this intimation is addressed.—Yours, &c.

London, March 3, 1831. **William Lea.**
No. 2, Foundry-row, Pitfield-street, Hoxton.

Emery Cloth. — W. H. W., who wishes to know where the emery cloth, described in our last Number, may be purchased, will probably obtain the requisite information by applying to Mr. Lowthorp, the inventor, No. 25, Crescent-street, Euston-square.

MISCELLANEOUS.

Lunar Theory.—The mode adopted by astronomers of determining the inequalities of the Moon's motion has been by approximating computations, which have led to results more or less accurate, according as they have been carried to a greater or less extent In a paper which Dr. Lardner has recently communicated to the Royal Society he has carried these approximations considerably further than any of his predecessors; and this he has been enabled to do by the employment of a method of calculation free from that multiplicity of small terms, which has hitherto made all investigations of this kind so lengthy and laborious. La Place, from the co-efficient of the equation, which depends on the Moon's distance from the Sun, calculated the Sun's horizontal parallax to be nearly 9″. Dr. Lardner makes it little more than 8½″, which is very near the mean of the various results obtained by observation of the transits.

Earthquake.—A violent trembling of the earth was experienced at Dover, Margate, Ramsgate, Deal, and other parts of the Kentish coast, about 8 o'clock in the evening of the 2nd instant. Houses and buildings were shaken, and many persons fainted from terror.

Civil Engineers, Surveyors, and Architects, are seldom unhealthy, except when they are irregular in their habits and addicted to high living. Though confined to the desk occasionally, yet they travel through the country, and thus enjoy fresh air and muscular exertion. They are indeed exposed occasionally to wet and cold, but these agents seldom injure persons in motion.—*Thackrah on the Effect of Arts, Trades, and Professions.*

Transmission of Sound.—It is mentioned in the Mechanics' Magazine, vol. xiv. p. 461, as something extraordinary, that the tap of a finger at one end of a log of wood should be heard at the other; but this example of the easy transmission of sound is nothing to the following:—At Carisbrook Castle, in the Isle of Wight, there is a well 200 feet deep, of 12 feet in diameter, and lined with smooth masonry; when a pin is dropped into it, the sound of its striking the surface of the water is distinctly heard!—T. V.

India Rubber Hats.—A manufacturer at Portland has succeeded in making very good hats from India rubber. They are very light, weighing on an average about four ounces; and are so elastic, that they may be folded like a handkerchief; may be crushed into any shape, and will immediately return to their original form without being injured in the smallest degree.—*American Paper.*

Dry Rot.—Chance, which often gives valuable information to observers, has pointed out a preventive of the rot in timber, that, while it promises to be efficacious, has, at the same time, cheapness to recommend its employment. It has been found that the timber used about the copperas-works in Whitstable, in Kent, has continued in a sound state for many years, which the seafaring people of that place attribute to its being soaked in the liquor that runs from the copperas stones, and are unanimous in thinking this would prove a complete preventive of dry rot; there is a greater reason to hope for a good effect from this, as the copperas liquor, by its sulphuric acid, has a decided action on every part of timber, somewhat analogous to that which charring has on its surface, by which it has been long known to be preserved where it would otherwise have decayed rapidly.—*Correspondent of the Repertory.*

INTERIM NOTICES.

A. T. B.—Our pages are always open to the correction of any misrepresentations that may appear in them; but we cannot promise to give insertion to the proposed reply to our Review of Dawson's Australia, should it resolve itself into a mere difference of opinion on the question of emigration. Not that we desire to shun discussion in this more than in any other case, but simply because we have not room for the multiplied controversies which a different course of proceeding would occasion. For the friendly hints with which A. T. B. concludes, we beg he will accept our best thanks. If he will send to our office next Saturday, there will be an answer waiting him on the subject of the J. of E.

The packet of our Manchester friend only reached us this morning (Friday, March 11); we regret the delay, since it obliges us to postpone for another week gratifying the party who expresses himself curious to know, what we think of certain recent exhibitions on the Railway.

Communications received from Mr. Elliot—Mr. J——s—Trebor Valentine—Mr. Saddington—Mr. Twiss—Mr. Baddeley—Usque.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 397.] SATURDAY, MARCH 19, 1831. [Price 3*d*.

> " Whenever it is thoroughly discussed, truth will not fail to come like tried gold from the fire; like Ajax, it requires nothing but daylight and fair play."—LAWRENCE.

THE APPROACHES TO THE NEW LONDON BRIDGE.

No. 2.

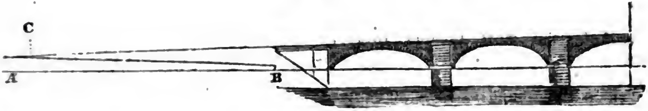
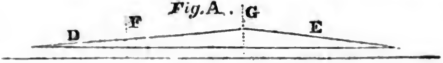


Fig. A.



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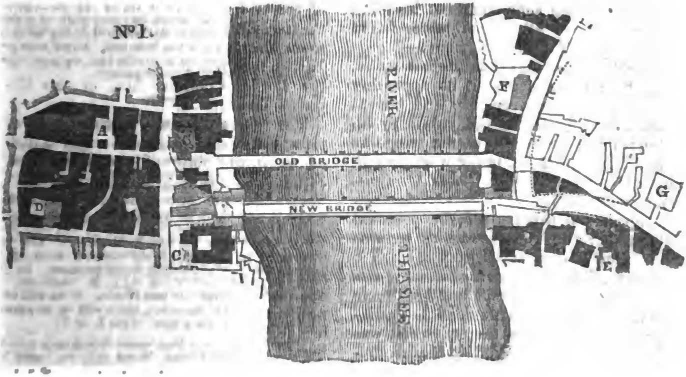

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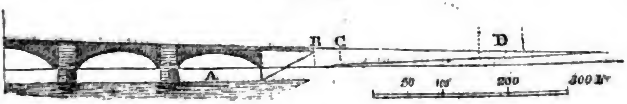
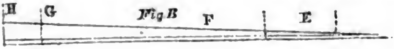


Fig B



DESCRIPTIVE ACCOUNT OF THE PRINCIPAL BRIDGES ERECTED OVER THE RIVER THAMES. BY MR. C. DAVY, ARCHITECT.

No. XVIII.

Alterations in the Design of the New London Bridge—Rennie's First Plan for the Approaches.

(*Resumed from p.* 403, *vol.* xiii.)

I shall now more particularly advert to the nature of the different plans for the approaches to the New London Bridge, and the circumstances that led to the several and expensive alterations in this magnificent structure.

It will be recollected that when the award was made on the different plans offered for the New London Bridge, those which were pronounced to be the best, abstractly considered, were abandoned on the ground of their being unsuited to the localities of this particular site. That the adopted plan of the late Mr. Rennie was equally if not more objectionable on this ground, will, I think, appear from the following extracts from the "Report of the Engineer of the New Bridge," which show that not less than three material alterations were found necessary in Mr. Rennie's plan:—

First Alteration.—The Report states, that "In consequence of its appearing that very great convenience and benefit would be afforded to the public by an alteration in the design of the bridge by the addition of 6 feet to the width, application was made to the Lords' Commissioners of his Majesty's Treasury for their approval and sanction of the proposed alteration; and their Lordships were so convinced of the expediency of such a measure, that they not only authorised its adoption, but in a liberal and handsome manner agreed to recommend to Parliament that the expense thereof (which was afterwards contracted for by Messrs. Jolliffe and Banks, at the sum of £42,000) should be defrayed by a grant out of the Consolidated Fund. Your Committee, in order to avoid the expense and uncertainty of raising money by bonds in the manner heretofore adopted by the Corporation in carrying into effect various other public works, also entered into a treaty during that year with the Lords' Commissioners of his Majesty's Treasury for the advance by them upon loan of the monies proposed to be raised on the credit of the Bridge House estates—to which their Lordships consented on the payment of interest at the rate of £4 per cent. per annum, with the addition of £1 per cent. per annum towards repayment of the principal; such payment to be made by half-yearly instalments, whereby the debt will be liquidated in a period of 42 years." Ultimately the whole of these arrangements were agreed to.

Second Alteration.—"During the latter part of this year (1826) your Committee's attention was directed to the propriety of making a further alteration in the design of the bridge, by adding two feet to the height of the two shore-arches, which we determined to recommend to your Honourable Court, in consequence of the engineer being of opinion that it was absolutely necessary for the general security and more perfect proportion of the bridge; and on their being assured that it would not be necessary on that account to purchase any more property for the formation of the approaches, the suggestion was duly authorised and adopted."

The *Third Alteration* was in the stairs of the bridge. The Report representing the necessity of this alteration was agreed to on the 5th day of April, 1827, after having received the necessary assent of the Lords' Commissioners of his Majesty's Treasury.

The whole of these proceedings took place before any final decision was adopted as to the form of the approaches. Strong fears began at length to be entertained that the new bridge, like that of Southwark, would be rendered comparatively useless from the want of adequate approaches, particularly on the north side. The original contract-plan for the approaches was rendered an absolute nullity by the great height of the new bridge, and by its oblique situation with regard to Fish-street-hill, thereby preventing a free and convenient access to its roadway. This plan, therefore, (see engraving) was finally abandoned. "In the multitude of counsellors there is wisdom," says the proverb; and, accordingly, we find other parties taking up the question and labouring for the general good in devising plans for characteristic approaches, and thus extricating those employed from the dilemma in which they were placed. The more prominent of these volunteer auxiliaries, Messrs.

Allen, Gwilt, Jefferys, and Lund, published certain pamphlets and prints illustrative of their own particular views. As a proof of the necessity for the interference of talented and scientific men, (to say nothing of the benefit derived from their joint labours) we need but refer to the pamphlet by Mr. Allen, wherein it is stated that "the engineers actually laid six plans for the approaches before the New Bridge Committee without either of them having yet (1827) been approved, or at least adopted." With reference to my own opinion respecting the ineligibility of the situation and design of the new bridge, I must freely admit it to be a case of great difficulty to determine with whom the blame lies. There is a discrepancy in two official statements which I shall here notice. The evidence of the late Mr. John Rennie, Mr. Mylne, and others, before the Committees of the House of Lords and Commons, was in direct opposition to the site and altitude of the present bridge;* while, in the Report I have quoted, the Committee observe, that they saw no reason to *depart* from the original design of the late John Rennie, Esq.! Again, in twelve or eighteen months afterwards, the site and proportions of the bridge were materially altered; and, above all, the abutments were placed directly facing a mass of the most valuable property, which has of necessity been since removed for the approaches.

Let us, however, do justice to the design and construction of the bridge itself. The same encomiums that were with justice passed upon Waterloo Bridge by a French engineer,† may, in a great measure, be applied to New London Bridge, which may in future ages remain to point out the situation of "a rich, industrious, and powerful city," when all around has passed away.

Explanation of the Engravings.

Plan No. 1.—This is the original contract-plan, showing the old and new bridges, with the approaches denoted by dotted lines. A, the Monument; B, St. Magnus Church; C, Fishmonger's Hall; D, St. Michael's Church; E, St. Mary Overy's, or St. Saviour's; F, St. Olave's; G, St. Thomas's Hospital.

No. 2 represents the half-elevation on the City side of the bridge, with the levels corresponding with the above plan. A, Trinity high-water mark; B, back of abutment; C, Thames-street.

Fig. A represents a section taken through Upper and Lower Thames-street. D, Lower Thames-street; E, Upper Thames-street; F, situation of Fish-street-hill; G, centre of the new bridge.

Fig. 2 represents the half-elevation on the Southwark side. A, Trinity high-water mark; B, back of abutment; C, opposite Tooley-street; D, St. Saviour's Church.

Fig. B represents a section taken from the back of the abutment to St. Olave's Church. E, St. Olave's; F, Tooley-street; G, centre of the new bridge; H, back of the abutment.

(To be continued.)

STEAM-CARRIAGE PERFORMANCES ON THE LIVERPOOL AND MANCHESTER RAILWAY.

We make the following extracts, Nos. 1, 2, and 3, from the *Manchester Guardian* of the 26th February.*

No. I.

"IMPROVEMENTS IN LOCOMOTIVE-ENGINES.

"It is tolerably well known, that the engines or locomotive-carriages used at the opening of the railway, were each propelled by two separate engines, the cylinders of which were placed on the outside of the carriage, over the hind wheels; and the power was communicated to the fore-wheels by attaching the connecting rod to a crank on the outside of each wheel. Now, as the two engines worked by alternate strokes, and communicated power to the outsides of the carriage, each stroke had a tendency to move that side of the carriage to which it was applied at a quicker rate than the opposite side; and the alternate advancing of the two fore-wheels caused considerable unsteadiness of motion, which entirely disappeared when the steam was shut off, and the carriage allowed to proceed by its acquired velocity. The effect of this unsteady motion is not only to impair the durability of the machine, but to diminish its power very considerably, by causing the flanches of the wheels to rub against the sides of the rails.

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* Repertory.

† See Britton's Illustrations of the Public Buildings, p. 322.

* But only received by us March 11—See Interim Notices, last Number.

"In consequence of this defect, Mr. Stephenson (we believe at the request of one of the directors) determined to try the effect of placing the cylinders beneath the boilers, and communicating the power to the wheels by means of two cranks on the axles, by which the tendency to twist the carriage would be very greatly diminished. This plan was reduced to practice in the construction of the Planet, and its consequences were immediately apparent in the steadiness of motion, and the very great working power of that engine. We believe it was estimated, that her effective power was nearly one-third greater than that of other engines of equal size, but made on the old principle—an increase which might be partly ascribed to the position of the cylinders beneath the boiler, when they were much better protected from the effects of a cold wind, or of rain, by which the temperature and pressure of the steam in the cylinders of the old engines, was, no doubt, at times considerably reduced.

"But this improvement, important as it was, proved to be only the forerunner of another, which will be found to be still more important, especially on lines of railway, where it may be found necessary to use inclined planes. It is well known that the engines generally used on railways were enabled to draw a load only by the adhesion to the rails of the two wheels, to which the moving power was attached; and that, in particular states of the weather, and in going up inclined planes at all times, great difficulty was experienced from the slipping of these wheels. It therefore became desirable that all the wheels should be coupled together, in order that the adhesion of the whole might be rendered available; but this could not be effected without making them all of an equal size, and that could not be done so long as the cylinders were placed over the hind wheels. By placing them, however, under the boiler, as in the Planet, the difficulty was removed, and Mr. Stephenson determined to construct two large engines, having the fore and hind wheels of the same diameter, and coupled together by connecting rods. Only one of these engines, very appropriately termed the *Samson*, has yet made its appearance on the railway; the expectations which were entertained of it have been not merely fulfilled, but greatly surpassed by its performances. It has repeatedly, without any assistance, taken from fifty to sixty tons of goods up the Huyton inclined plane (an elevation of one in 96), at an average speed of about ten miles an hour; a performance, which was previously supposed to be quite beyond the powers of a locomotive engine, of any moderate or manageable size. But even these exploits have been completely thrown into the shade, by one which was performed yesterday; the particulars of which are detailed in a paragraph subjoined (No. 2). It is, perhaps, necessary to state, that the Samson has 14-inch cylinders, and weighs, with water in the boiler, little more than eight tons."

No. 2.

"EXTRAORDINARY PERFORMANCES OF MR. STEPHENSON'S ENGINE, SAMSON.

"Yesterday morning (25th February), Mr. Stephenson's engine, the ***Samson***, started from the station at Liverpool with 30 waggons, carrying the following load:—

	Tons	Cwt.
23 waggon load of oats	82	10
7 waggon load of merchandize ..	24	15
Total nett weight..	107	5
Tares of the 30 waggons	42	15
15 persons (chiefly directors and their friends)	1	
Making the gross weight of ..	151	

(besides the weight of the tender, with its coke, water, &c.) With this enormous load, the Samson moved off at ten minutes past eight, and proceeded to the foot of the inclined plane, at the rate of about twenty miles an hour It was assisted up the inclined plane by three other engines, (the ***Mars***, the ***Mercury***, and the ***Arrow***), and arrived at the top in 38 minutes after leaving the station. As the assisting engines pushed behind the load, whilst the Samson tugged in front, it was easy, by observing where the connecting chains were tight, and where slack, to ascertain what portion of the work was done by each, and it was found that the Samson generally drew sixteen waggons, the gross weight of which would be about 80 tons; on arriving at the top of the inclined plane, the Samson stopped five minutes to take in water, and then proceeded to Park-side, where it arrived at 29 minutes past nine, stopped there eight minutes to water, and arrived at Manchester at sixteen minutes before eleven. The whole time of the journey was, consequently, two hours and thirty-four minutes, and deducting the thirteen minutes employed in taking water, the nett time of travelling was two hours and twenty-one minutes. From the performance of the Samson on the inclined plane, no doubt is entertained that it would draw 200 tons on a perfectly level railway. The quantity of coke consumed by the Samson in this extraordinary journey was 1376lbs. (12cwt. 1qr. 4lbs.), being not quite one-third of a pound per ton per mile. Adding to this, the coke consumed by the three engines which assisted up the inclined plane, the whole expense of fuel would not amount to twenty shillings. We imagine that the performance yesterday, will, at any rate, put an end to the system of petty detraction, which has been so long and so incessantly levelled at Mr. Stephenson and his engines, by a little knot of pseudo-mechanics,* who appear to have imagined, that they had an interest in depreciating every thing he did, and in crying up even the blunders and the failures of other parties. We are very curious to see how this, and some other recent occurrences, will be treated in the Mechanics' Magazine, the organ of the party to which we have alluded."

No. 3.

"FINAL TRIAL OF MESSRS. BRAITHWAITE AND ERICSSON'S ENGINE.

"We mentioned last Saturday (February 19th) the journeys made on the preceding day by Messrs. Braithwaite and Ericsson's engine, the King William, to and from Manchester and Liverpool. These journeys were only preparatory to a trial of the engine with a load of goods which, *we believe*, was understood between the Directors and Messrs. Braithwaite and Ericsson, to be final so far as the Manchester and Liverpool Railway was concerned. This trial was made on Saturday morning, when the William started from the Manchester station at 15 minutes before 9 o'clock, with a load of 5 waggons, the gross weight of which was 20 tons, 6 cwt. 1 qr. After getting fairly in motion, the William proceeded for about two miles at a speed of about 10 miles an hour, which however gradually declined to about 6 or 7, and occasionally to less than 5 miles an hour, and it was very obvious that the engineer *could not succeed in keeping up an adequate supply of steam.* At the conclusion of the first hour the William had gone exactly 8 miles and a half, the greater part of which was on a descent of about 4 feet in a mile, and the rest a dead level. After proceeding about 3 miles further at about the same average rate, two of Mr. Stephenson's engines came up with a load of goods, and pushed on the William and Meteor, which had followed it to the watering-station at Parkside. The William and the Meteor were then transferred to the other line to allow the engines to pass. The William then proceeded towards Liverpool with its load, but after going two or three miles at the same indifferent rate as before, it became obvious that it would be overtaken by the 10 o'clock train of passengers from Manchester; and the Meteor assisted in pushing on the load to the foot of the inclined plane, when the 10 o'clock train was allowed to pass. The engineer who had the charge of the William declined attempting to mount the inclined plane with the load, or indeed to proceed any further with it, and the 5 waggons were consequently carried on to Liverpool by the Meteor."

REMARKS.

The writer of the preceding articles expresses himself "very curious" to know how they "will be treated in the Mechanics' Magazine;" and his reason is, that the Mechanics' Magazine is "the organ" of a party which has been guilty of "a system of petty detraction, long and incessantly levelled at Mr. Stephenson and his engines." Were there any truth in his accusation, there would be something very natural in his curiosity; but the one is as false as the other is feigned. He knows well that he has nothing but what is fair and liberal to anticipate from us. The Mechanics' Magazine is the organ of no party, and has never been an instrument of "petty detraction" towards either Mr. Stephenson or any other individual whatever. We may not have expressed so high an opinion of the works of Mr. Stephenson's hands as others have done—and no wonder, since nothing less will content his partizans than to rank him with the Watts and Davys of the age!* but we defy any one to show that we have ever suppressed or misrepresented a single fact that could testify in his favour, or serve to show that our opinion of his merits was wrong. Nothing that any of his engines ever did, or were ever reported to have done, have we concealed from our readers; and where we have not described what we ourselves saw, we have invariably given the accounts of others as we found them. And in this, consists the great difference on this particular question, between the Mechanics' Magazine and the *Manchester Guardian.* The Mechanics' Magazine has its own—perhaps a peculiar—opinion of Mr. Stephenson's merits as an engine-maker, but sticks to truth in support of it; the *Manchester Guardian* has somewhat of an opposite opinion, and thinks an adherence to truth in maintaining it exceedingly superfluous. For proofs of this, we refer to our 378th, 380th, and 391st Numbers, where the reader will see it established beyond the possibility of refutation, that the *Guardian*, in order to uphold Mr. Stephenson, and cry down his rivals, has not scrupled to tell lies by the bushel; and has even, to suit its purpose, deliberately put into the mouths of its antagonists words which they never used. Verily, it greatly becometh so habitual a detractor, to hold up his hands at the sin of "detraction!"

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* "Of course we do not include in this term Captain Ericsson, who is unquestionably a man of considerable mechanical talent."

* Vide Mr. Booth's Account of the Liverpool and Manchester Railway, p. 94.

In truth, knowing what we do know of the proceedings of Mr. Stephenson and his partizans, it strikes us as something quite wonderful that THEY, or *any of them*, should be the parties to cry out "foul play." More illiberal conduct towards a rival than has been all along displayed by Mr. Stephenson, and those in his employment, towards Messrs. Braithwaite and Ericsson, we have seldom witnessed. The sneers, the taunts, the hindrances, the annoyances, by which they have uniformly endeavoured to discourage *the strangers*, and to drive them from the field of competition, are known to all the "railway train." Hundreds there are who can bear testimony to something of the sort, more or less pitiful; but not one, we make bold to say, who ever heard Mr. Stephenson say a kind or encouraging thing of his rivals or their engines. We can ourselves testify to his deriding, in a strain of coarse exultation, a peculiarity in the construction of Messrs. Braithwaite and Ericsson's engines, which, as we shall presently show, he has himself since adopted, (though without acknowledgment) and now reckons to be an improvement of the first water. But why need we appeal to what Mr. Stephenson has been heard to say, by ourselves or others? Mr. Stephenson's own flesh and blood shall bear testimony, in black and white, to the injustice with which he has treated his rivals. In "An Account of the Competition of the Locomotive-Engines at Rainhill, in Oct. 1829," which was afterwards published by "Robert Stephenson and Joseph Locke, Civil Engineers," the one the son, and the other an assistant of Mr. George Stephenson, and which had doubtless the father's entire sanction, it is said of the Novelty,—"this engine is *so far novel* as to carry the requisite quantity of water and fuel on the same carriage with the engine." —"So far" *only!* Talk of detraction after this!

Such conduct in Mr. Stephenson is the more reprehensible, that, as engineer to the Railway, he owes it to his employers to give every possible encouragement to competitors, and not to suffer any separate interests of his own, as an engine-maker, or partner of an engine-making company, to interfere with an upright discharge of his duty.

But, pass we from these personal matters, to the more pleasing task of gratifying the curiosity, which Mr. Stephenson and his friends have expressed, to see how the occurrences related in the preceding extracts will be treated in the Mechanics' Magazine.

We have no hesitation in frankly acknowledging, that, by all that relates to the performances of the Samson, we are at once surprised and delighted. Not that its performances go beyond what scientific men have expected would sooner or later be achieved—nor even that we despaired of seeing an engine of such might, produced by Mr. Stephenson; but surprising it is to us, that so vast a stride should all at once be made from the degree of power exemplified in the Planet, Meteor, and other engines, of this gentleman's manufacture, to that exhibited by the Samson—and most delightful to think, that ere six months have elapsed since the opening of this, the first extensive railway for general traffic, there has been that accomplished upon it, which transcends all ordinary expectation, and places beyond all question the immeasurable superiority of the railway system over every other mode of conveyance.

The improvements by which the Samson has been rendered so much more powerful than its predecessors, are stated in the extract, No 1, (which we shall not, perhaps, greatly err, in ascribing to Mr. Stephenson himself, or his partner Mr. Booth) to be two-fold. First, there is the application of the power to the axle, instead of to the outside of the wheel, and subordinate to that, the removal of the cylinders from the upper part of the carriage, between the hind wheels, to a situation below the boiler. And second, the employment of four wheels all of one diameter, and the coupling them together by connecting rods. The former of these improvements is stated to have been suggested by "one of the directors." The latter, the reader is left to infer, is a contrivance of Mr. Stephenson's own. Now, it so happens, that with the exception of so much of the "Director's" suggestion, as relates to the removal of the cylinders from the top to the bottom of the boiler—an alteration, the benefit of which appears to us to be greatly over-rated—there is not an iota of these improvements, to which either the Director or Mr. S. have the smallest claim.

First, as to the application of the power to the axle—this is precisely the method which was adopted in the case of the Novelty; so also is it the method followed in the William and the Adelaide. Again, the employment of wheels all of one diameter, and the coupling of them together to increase the adhesion—this is that very peculiarity of construction, of which we have before spoken, as having been so coarsely derided by Mr. Stephenson when he saw it exhibited in the Novelty! The reader who refers to the engraving of the Novelty, in our 323rd Number, will not see there any coupling-rods or chain; but, it is a fact, which can be attested by thousands, that when the Novelty first made its appearance on the railway, at the competition in 1829, the wheels were connected together by an endless chain, which was afterwards thought to be superfluous, in a trial which had speed more than power of draught for its object. Nor are these things even peculiar to Messrs. Braithwaite and Ericsson; the Sanspareil of Mr. Hackworth had also wheels of one diameter connected together by coupling-rods.

Mr. Stephenson is entitled to the praise of having adopted certain useful methods which, in his days of greater ignorance, he derided, but that is all; he would have been entitled to more, had he candidly and honourably acknowledged to whom his thanks are due.

It will be observed, that a statement is given of the quantity of fuel consumed by the *Samson.* This is *the first time* that we have been favoured with any information of the sort from Mr. Stephenson. Often has he been called upon to say what his engines consumed; but never before, has he thought fit to satisfy the reasonable curiosity of the public on this point. The quantity is exceedingly small; much smaller, we feel bound to say, than what we have all along thought a boiler of the description used by Mr. Stephenson would require.

It remains that we should say something of what is called the "Final Trial of Braithwaite and Ericsson's Engine." *Final—positively final* it is called in the title of the article (No. 3); and we dare say there are hundreds and thousands of superficial readers, who, looking no further than the title, have gone impressed by it with a notion, that there is actually an end to the engine, and to the hopes of its makers. But what do we find on an examination of the article itself? The absolute assertion of the trial being a final one, repeated? By no means. The writer only *believes*—that it was *understood*—to be a final trial; not *altogether* final either, but only final "so far as the Liverpool and Manchester Railway is concerned!" Who so entitled to cry out against detraction as a word-eater like this! The truth, as we are informed, is, that the trial was no more final than any of those which preceded it; and of this one strong proof is, that neither Mr. Ericsson nor Mr. Braithwaite were present on the occasion—another still stronger, that the load assigned to the carriage to draw was not that which Messrs. Braithwaite and Ericsson contracted it should draw—not 40, but 20 tons.

But whether the trial was final or not, we are free to confess, that it is of a nature well calculated to cast down the hopes which people have been led to entertain of Messrs. Braithwaite and Ericsson's engine. It may not have started to do its best, but the circumstances which arose were such as to call for its best exertions. It had been greatly damaged by the accident which befel it last September, but had since undergone a complete repair, and when last on the road had been pronounced by Mr. Ericsson to want only the addition of an expansion-slide—which addition had been subsequently made to it—to be all that he could desire. That after all this delay and preparation it should, under any circumstances, have performed so ill, surprises us not a little. Indeed, were we to judge by results merely, we should be induced to say there was an end of the affair. But, we refuse to despair of the success of this engine, because we feel so well persuaded of the correctness of the principles on which it is constructed, that we are certain its present failure can only have arisen from some defect in the details of the machinery, admitting of a remedy; or from some unskilfulness in management, which ought not to have occurred. The report states, that the engineer could not keep up the steam! And yet we have seen that when the engine was previously tried under the direction of Mr. Ericsson himself, on the 14th of Jan. last (Mech. Mag. No. 389) the steam generated was generally in excess. To what but some blunder in management can we attribute such a difference as this?

It is important to keep in mind, that the point on which the success of Messrs. Braithwaite and Ericsson's carriage turns, is simply the efficiency of the boiler. Wheels of equal diameter are common both to Mr. Stephenson and them; so also is the application of the power to the axle; and whether the cylinders are above or below the boiler, in the front or in the rear, is (we apprehend) a matter of much indifference. Now, that Messrs. Braithwaite and Ericsson's boiler is a very excellent boiler, is a fact, which it is fortunately not left to these railway experiments to determine; a number of the most eminent engineers and men of science of the day, have concurred in pronouncing it to be, in respect of rapidity and economy of production, the very best boiler ever invented; (see Mechanic's Magazine, vol. xiii. p. 309) and many are the boilers of this description, which are already in successful use in distilleries, breweries, sugar refineries, &c. in and about the metropolis. It is at the same time, remarkable for the very small space it occupies. Why then should it fail in its application to locomotive machinery? We see no reason, and can imagine none.

We are not so sanguine in our hopes of this boiler, as to suppose that it will ever greatly surpass the boiler of the Sampson in the quantity of steam it can produce in a given time, or even in the smallness of its expenditure of fuel; but we fully expect to see other advantages realized, that will give it a decided superiority. All the recent boilers of Mr. Stephenson—that of the Samson, we presume, among the number—are on the multi-tubular plan; and they are kept working on the plugging and replacing system—that is to say, as soon as a tube gives way it is stopped up, and when any considerable number of them are thus put *hors de combat*, new tubes are substituted for them. The great expense and inconvenience thus occasioned, will all be saved in the case of Messrs. Braithwaite and Ericsson's boiler. It has a flue of only three turns, and so little is it liable to be injured by the fire, that we have seen one which has been in constant use for upwards of two years, and is still perfectly sound in every part.

The reader will observe, there is a note of a very peculiar kind subjoined by the editor of the *Guardian* to No. 2, respecting Mr. Ericsson. We do not notice it for the sake of our own particular share in the classification, to which Mr. E. is pronounced to be an exception; we willingly leave our knowledge of mechanics to speak for itself; but we notice it for the purpose of reprobating the unfair distinction which it is the insidious design of this note to establish between Mr. Ericsson and his partner. The object of the writer is evidently to impress the reader with a notion that the delay in producing the William in a state fit for the duty which it has been contracted it shall perform, has been owing to certain mechanical "blunders;" but that whoever is to blame for these blunders, Mr. E. is not. The *Guardian* does Mr. E. great injustice in supposing that he can feel honoured by any compliment at the expense of his partner (of whom, by the way, it may be said, without flattery, that it would be sufficient honour to any man to rival him in practical knowledge and skill.) And it does also a great violence to truth in the attempt to separate Mr. E. from any blame that may *possibly* attach to the case; the fact being, that Mr. E. is even more identified than Mr. Braithwaite with the recent fortunes of the engine—having had it for several months past under his immediate and exclusive superintendence.

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THE PLANETS MERCURY AND VENUS.

Sir,—As it is most likely that comparatively few of your readers are in possession of Vince's Tables, I take the earliest opportunity (having but just received part 97) of sending you a couple of computations from them, to fulfil the request of your astronomical correspondent (vol. xiv. p. 416). This gentleman's difficulties have probably arisen from a want of the consideration that the places of the planets are stated in the Ephemeris for *apparent*, and not for *mean* noon. Presuming that the heliocentric longitudes are alone sufficient, I beg to insert two, one for Mercury, and one for Venus, for apparent noon, on days when the equation of time is considerable, that the difference may be more obvious. Should this correspondent still find difficulties which he cannot surmount, I shall be happy in using my best endeavours to set him right, either in this Magazine or by letter in a private way.—Yours, &c.

W. D. Snooke.

Ryde, March 10, 1831.

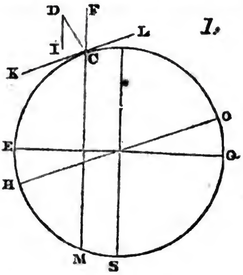
Helio. Long. Mercury, 1830, *Feb.* 13*th.*

Time.	Mean Long.	Aphelion.	Node.
	s ° ′ ″	s ° ′ ″	s ° ′ ″
1820	4 3 1 5	8 14 39 36	1 16 11 14
10 years.	6 5 21 40	9 22	7 13
1830	10 8 22 45	8 14 48 58	1 16 18 27
February 13.	6 0 3 53	7	5
0 hours, 14 min.	2 23		
34 sec.	6		
	4 8 29 7	8 14 49 5	1 16 18 32
Tab. V.	+ 21 47 59	4 8 29 7	5 0 17 6
	5 0 17 6	7 23 40 2	3 13 59 34
Tab. VII.	+ 6 3	Hence in the Ephemeris it is	
Nutation.	— 2	° ′	
True long.	5 0 23 7	0 ♏ 23	

Helio. Long. Venus, 1830, *Nov.* 7*th.*

Time.	Mean Long.	Aphelion.	Node.
	s ° ′ ″	s ° ′ ″	s ° ′ ″
1820	10 29 0 14	10 8 52 24	2 15 2 28
10 years.	3 1 7 14	8 6	5 10
1830	2 0 7 28	10 9 0 30	2 15 7 38
November 6.	4 16 40 20	41	26
23 hours.	1 32 7		
43 min.	2 52		
50 sec.	3		
	6 18 22 50	10 9 1 11	2 15 8 4
Tab. V.	+ 44 13	6 18 22 50	6 19 7 3
	6 19 7 3	8 9 21 39	4 3 58 59
Tab. VII.	+ 2 47	Hence in the Ephemeris it is	
Nutation.	— 8	° ′	
True long.	6 19 9 52	19 ♎ 10	

THE PRINCIPLES OF DIALLING.



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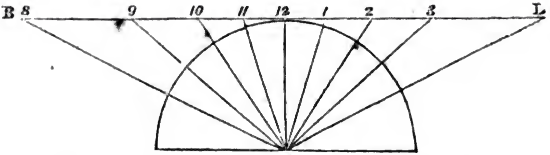

2.

Sir,—The subject of dialling having been mentioned in your 10th and 12th volumes, it is my intention to present your readers with the theory of the art, in as plain and concise a manner as possible; for, being a self-taught person, I have often found a great advantage in having the theoretical part of a science before me, in a condensed manner: first, because it is sooner learnt than the subject in its full details; and, secondly, because a knowledge of the fundamental principles of any science easily gained, stimulates and encourages the mind to further exertion, and leads on to a complete proficiency.

The equator being divided into 360 degrees, and the earth revolving in its axis in 24 hours, 15 degrees of the equator are passed over by the Sun in every hour.

Imagine the Earth to be a transparent shell, having an opaque axis, and on it imagine 24 lines to be drawn from pole to pole, representing the hour-lines. Let us also imagine a plate of metal to be put inside the shell, capable of being placed in any position. The plate being fixed in any required position, and the axis passing through its centre, as the earth turns round, the sun will of course cast the shadow of the axis on the plate in an opposite direction, thus serving as a gnomon; and the hour-lines of the dial will be marked out by the shadow. The positions of the hours will be also marked on the edge of the plate by the aforesaid lines on the transparent globe.

This is the foundation of the art of dialling; for in practice, that edge of the gnomon which casts the shadow is brought parallel to the axis of the earth; the plane of the dial is brought parallel to some great circle of the earth; and the distances of the hour-lines on the dial are the same as if the plane were placed inside the before-mentioned sphere, and cut by the lines as aforesaid. The distance of the surface of the earth from its centre is but as a point, compared to the distance of the earth from the sun; and therefore the same will take place at the surface as at the centre, or at least the difference will be inconsiderable.

The whole of the requisites for constructing a sun-dial therefore are, the distances of the hour-lines on the plane, and the angle which the gnomon must make with the plane, so as to be parallel to the axis of the Earth. The angle for the gnomon of an horizontal dial to make with the plane thereof, will be equal to the latitude of the place; and the same angle for a north or south vertical dial to make with its plane, will be equal to the complement of the latitude. This may be rendered more plain by fig. 1, in which NS is the axis of the earth; EQ, the equator; HO, the horizon; KL, the plane of an horizontal dial for the place C; MCF being parallel to NS; CF is the gnomon of the dial; and the angle FCI is equal to the latitude of the place, or is measured by the arc EC.

Again—let DC represent the plane of a vertical dial whose gnomon is DI, parallel to FC, and consequently to NS; I say the angle D is equal to the complement of the latitude, or is measured by the arc CN. This, as well as the preceding, will be evident by referring to Euclid 1. 29. The hour distances of an horizontal dial, allowing 15 degrees for the distance of each hour from the meridian (or 12 o'clock line) or the equator, are found by the following theorem:—

Log. sine of the latitude + log. tan. of the hour's distance on the equator—radius = log. tan. of the same hour's distance from the meridian on the dial-plane.

And the same will hold good for a vertical north or south dial, by using the log. cosine of the latitude instead of the log. sine.

It is evident that the gnomon of an horizontal dial at the equator, to be parallel to the axis of the Earth, must make no angle at all with the plane; and therefore the hour-lines must be parallel to each other. This dial, therefore, may be made by describing a semicircle, and setting off the hour distances 15 degrees each, as in fig. 2, and drawing lines from C to the hours as numbered in the fig. on BL, which is the dial-plane, and is a tangent to the two quadrants. Or the dial may be constructed by setting of the natural tangents of the hour distances on the plane, making the height of the gnomon equal to the tangent of 45 degrees, or equal to the radius of the semicircle.

By fig. 1 it will appear that an horizontal dial for any latitude will be a vertical dial for a place whose latitude is the complement of the former; and consequently an horizontal dial at the equator will be a vertical one at the pole. An horizontal dial at the pole will be nothing more than a circle divided into 24 equal parts, with a pin in its centre for a gnomon, the pin being a seeming continuation of the earth's axis, and the plane of the dial being parallel to the equator. And this by the former consideration will be a vertical dial at the equator.

Since the plane of an east or west dial is parallel to the meridian, its lower edge being parallel to HO, it is evident that its gnomon, to be parallel to NS, must make the same angle with the lower edge of the plane as NS does with HO, or, in other words, this angle must be equal to the latitude of the place. If, therefore, a dial horizontal at the equator, be elevated till its gnomon makes an angle with the horizon of any place, equal to the latitude of that place, it will of course be an east or west dial for that latitude; and hence the reason why the gnomon and hour-lines of an east or west dial must make an angle with the horizon equal to the latitude of the place for which it is constructed.

Thus is explained the nature of all sun-dials whose planes are known to be parallel to some great circle, or to face any of the cardinal points; but, for the most part, dials fixed against walls decline from one cardinal point towards another. Such dials have their planes parallel to the horizon of some place of another latitude, whose longitude is east or west of the place for which the dial is to be made. In this case, a new latitude may be found by the following theorem:—

Log. sine of declination + log. cosine of given latitude—radius = log. sine of latitude required.

And the following theorem will give the longitude:—

Log. sine of given latitude + log. cotangent of given latitude—radius = log. cotangent of longitude required.

Therefore, an horizontal dial for the latitude thus found, whose gnomon is distant from the hour-line of 12, equal to the longitude, will be the required vertical declining dial for the given place. And thus, in a few words, is contained the whole theory and fundamental principles of the art of dialling. This art was much cultivated by the practical mathematicians of this country about 160 years ago; but at the present time, clocks are brought to so great a degree of perfection, and the practical part of dialling being likewise cast into the hands of the mathematical-instrument maker, the study has so far degenerated, that not one modern treatise on the subject is to be procured.

The best way to explain the principles of this art is by a globe, as every operation is by that means rendered plain and easy. The "Universal Dialling Cylinder" of Ferguson, which he regarded as one of his best contrivances, is well adapted to the purpose, and is an instrument which, with a little addition, may be applied to more useful purposes than perhaps its inventor thought of. This I may at a future time describe, and apply to what I am alluding.

Yours, &c. J. GREENALL.

Feb. 2, 1831.

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SAXULA'S NEW LOCOMOTIVE THEORY,—TWELVE FUNDAMENTAL PROPOSITIONS.

Sir,—Having, at various times, in the pages of your useful publication, rather boasted of the superior powers of my steam-carriage, the "Triumph;" and claimed, as my own, the discovery of the true theory and principles of locomotion, partially illustrating the same by the singular wheel-barrow problem, &c., and being one who is desirous of saying no more than he can prove, I now beg the insertion of a few papers, in which I will demonstrate the truth of my assertions, that the mechanical principles on which the "Triumph" is built, are the only ones by which a locomotive vehicle on plain wheels, without crutches or propellers, can surmount the hills, ruts, stones, and sloughs of a common road.

In the first place, to shorten the process, I assume, as true, (believing them to be so), the following twelve propositions or postulates, and leave your scientific readers to say, if they consider any of them erroneous.

1st. That the power of descent (and consequently weight to be raised, or resistance to be overcome), of a loose body on an inclined plane, is equal to the perpendicular height of that plane, when the length of the plane represents the weight of the body—in other words, if radius represent the weight of the body, the sine of the angle of inclination of the hill will represent the power of descent.

2d. That when loose bodies remain at rest on an inclined plane, and do not slide down, it is by reason of friction.

3d. That friction is various, in various bodies and surfaces, and that it may be, and often is, equal to one-third of the weight of the body on the inclined plane, and increases as the weight of the body increases.

4th. That when the power of descent of a loose body on an inclined plane exceeds the friction, the body will roll or slide down.

5th. That an engine or mechanical power, suppose equal to 100lbs. carried by a wheel, and trying to start that wheel forward (as in locomotive machines) is only equal to 100lbs. weight hung by a line on a horizontal spoke of the wheel, at the place where the engine power is applied to that wheel.

6th. That if power, applied to a lever and multiplied by its distance from the fulcrum, be more than equal to the weight to be raised, multiplied by its distance from the fulcrum, the weight will be raised by the power.

7th. That the centre of gravity of a body, is the place of the whole weight of that body, and by lifting the centre of gravity, the whole body is lifted.

8th. That a stone under a moving loaded wheel, is equal in resistance to a short hill, and becomes a fulcrum, on and over which the moving weight is to be lifted.

9th. That locomotive-carriages, as now generally built, are worked by machinery, ultimately resolvable to a first class lever, having the fulcrum between the power and the weight.—*(See Note subjoined.)*

10th. That the power of a first-class lever is greatest when the weight rests on or near the fulcrum, and least, or nothing, when the power acts on or near the fulcrum.

11th. That a certain power acting on the end of a lever, is only of the greatest lifting effect when the line of direction of that power is at right angles with the lever.

12th. That if a weight of, say 100lbs., must be made to ascend 1 foot perpendicular per minute, a power to do it of 100lbs. must descend, or be exerted through one foot in the same time, whatever be the description of machinery used, or a power of 1lb. must descend

100 feet, or 2lbs. 50 feet, in the same time, or in like proportion.

Note.—I am one who considers there is effectually only one mechanical power, namely, the lever, to which all the rest are reducible. The wedge, for instance, is only a mean or tool for conveying power to a second class lever, whose long arm could not otherwise be so forcibly and conveniently operated upon. As supposing a crow-bar were put into the horizontal crack of a rock, if the bar be forced downward it becomes a first class lever; if upward, a second class lever; if onward by a blow, a wedge conveying that blow to the upper part of the rock, which acts in all these cases as the power-arm of a very powerful lever, whose weight and fulcrum lie in the unsplit part of the rock. The thinner the wedge, the greater weight it will lift with the same blow; but then the height will be less; thus, as in all other levers, gaining power by losing time or distance. I believe all these propositions, excepting the 5th and 9th, are as familiar to the circle of your scientific mechanical readers as "household words."

I should be very glad to see the fifth proposition shortly and clearly demonstrated · I believe it to be quite true, but can only prove it in a roundabout way; I will just premise thus much. Suppose a man standing on the ground were to attempt, in an inclining direction from behind, to force forward a heavy carriage by pushing at the axle of the wheels, the re-action of his efforts would be made by his feet on the immoveable earth; consequently, if any thing moved, it must be the wheels—but, if he stood on any part of the carriage, and made the same efforts, the re-action would be on the moveable carriage, free to go backward as forward; consequently, in this position and direction, there would be no propelling force at all—it would be the man in the boat.

As the truth of my locomotive theory, mainly depends on the correctness of these propositions, especially the 5th, I leave them awhile for consideration, and will then go on to their application. In the mean time, I fully trust some of your able correspondents will give their attention to them, as to a thing of more than every-day importance, that I may have an opportunity of answering objections, or correcting my theory. I present my bullion for assay, and request its purity may be tested before I cast it into vessels, or stamp it into coin.—Yours, &c.

SAXULA.

P. S.—In reply to the remarks of your correspondent Sivado, No. 394, p. 463, I beg to say, that I do not admit the principles or powers of the little "Triumph" to be impugned on slight grounds, and I consider his objections as very slight. He will, perhaps, think them so himself, when I inform him, that so far from not having given "consideration to the gravitating point of my machine," I have paid the nicest attention to it, and it is only by a strict attention to this very point, that an extreme degree of ascent can be accomplished. Sivado's diffidence may argue skill, as the more a man knows, the better he is aware of the disproportion his knowledge bears to what is unknown. Elevation enlarges view; and I will thank him to scrutinize my twelve propositions.

S.

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NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

IMPROVED FERMENTING APPARATUS, *E. Riley*, *Thanet-place, Strand.*—The working tun is divided by an horizontal partition into an upper and lower chamber; care being taken that the lower chamber is not larger than will hold the quantity of liquor intended to be fermented at one time. An open trunk or chimney rises from the centre of the dividing partition to about one-third of the height of the upper chamber; and at a little distance on each side of this chimney there is a valve in the partition, which can be opened or shut at pleasure by a rod or handle that passes to the exterior of the apparatus. A further communication is established between the two chambers by means of an air-tight pump affixed on the outside. Through the centre of the upper chamber passes a rotary shaft, provided with fans like those of a hand-churn; a space being left to enable the fans to turn clear of the chimney before described. In the top of this upper chamber, there is on one side a trap-door for charging the working tun, and on the other a safety-valve, for letting off gas, if necessary, to prevent the tun bursting; and, between these, there is an aperture, glazed with strong glass, through which the process of the fermentation may be watched, and access can be had to remove the yeast when the process is over. The whole apparatus is made air-tight. The mode of using it is this: the liquid and yeast are poured into the upper chamber; the fanner or agitator is turned for a short time, and then the mixture is let down into the lower chamber, through the valves in the horizontal partition. As the mixture works up the interior chimney in the process of fermenting, other portions of it are raised by the pump on the outside, from the lower to the upper chamber, and the whole being remixed as before, by means of the agitator, is again returned to the lower chamber. The same operation is repeated till the fermentation has been carried as far as the brewer or distiller wishes, when the liquid is finally drawn off in the usual way by a cock at the bottom of the lower chamber. The patentee states, that he has tried his method repeatedly, and finds that it produces a far better article than the common plan.—*Date of Pat. July* 19, 1830*; of Spec. Jan.* 19, 1831.

IMPROVEMENTS IN PROPELLING MACHINERY, *J. Ruthven, Edinburgh*.—1. An improvement in paddle-wheels; the float-boards are to be spoon-shaped instead of flat. 2. A contrivance for converting an alternating into a continuous rotary motion. And 3. A new method of working ships and other pumps.—*Date of Pat. Aug.* 5, 1830; *of Spec. Feb* 5, 1831.

MR. DOBREE'S INDEPENDENT SAFETY-BOAT.

Sir,—Amongst the specifications mentioned in the last Number of the Mechanics' Magazine, I find that of a patent which has been granted to myself for an "Independent Safety-Boat." It is therein reported to "consist in rendering the boat buoyant by air-tight copper tubes;" and concludes with stating that "the same thing was proposed by a Mr. Watson, about a year ago, and by many others before him." Buoyancy by copper tubes, and wooden boxes, (both of which, in fact, are introduced into the "Independent Safety-Boat") allow me to observe, form but a secondary consideration; so little indeed regarded in my invention, that were the bottom of the boat, with the whole of the boxes and tubes, removed, its floating power would remain unaffected. The main feature indeed of the invention, and which struck me as possessing considerable importance, is "THE SPEEDY AND TOTAL DISPLACEMENT OF SHIPPED WATER" by the most simple method possible, without the aid of pump, of baling, or shifting of position by the crew and passengers. From this brief explanation it will readily be perceived that my invention is *totally different, in main principles*, to any thing of the kind hitherto attempted; and, consequently, to the description given in your interesting publication. Apprehensive of sustaining serious injury from such an erroneous statement if uncontradicted, I have ventured thus addressing you, trusting to your candour and impartiality for the correction thereof in your next Number.

Yours, &c. WILLIAM DOBREE.

Fulham, March 11, 1831.

[Having written to Mr. Dobree, pointing out what we conceived to be a defect in the preceding vindication, namely, that it did not explain how the displacement of the shipped water is effected, we have received from him the following reply.—ED.]

Sir,—In my letter of the 11th instant, relative to an incorrect report in the Mechanics' Magazine, of my invention of "An Independent Safety Boat;" I conceived that a statement, merely disclaiming its similarity to any previous discovery of the like nature, might have sufficed to remove the unfavourable impression, which the implied absence of originality was calculated to create:—Indeed, it was my wish, by brevity, to trespass upon your columns, as lightly as possible. Your favour of the 14th, however, suggesting the propriety of my being more explicit, in regard to the distinguishing feature of my invention, namely, "*the entire displacement of shipped water*," I can feel no hesitation in supplying the omission.

The method of effecting this important object consists in the application of an independent deck, with convex surface, attached to air-boxes and cylinders, placed beneath it. Thwart beams, made doubly concave, are introduced between this and the upper or main deck. The under concavity of these beams resting upon the convexed independent deck, and the upper concavity receiving the main deck, which is necessarily concave, a considerable opening is left in the centre of the upper deck, longitudinally; besides which, are openings between the futtock, or side timbers—so that, into whatever position the boat may be thrown, the whole of the shipped water passing with rapidity either through the centre, or lateral outlets, or both, on to the lower or independent deck, must, consequently, continue its progress to the sides, and completely discharge itself at the scuppers. Thus my former assertion, as to the "*total displacement of shipped water, without the aid of pump, of bailing, or the shifting of position by crew and passengers,*" is fully established.

The ingenious mechanic will readily perceive, that the boat's space is not interfered with by this arrangement, which is another interesting feature, and one hitherto but little regarded; inventors having mostly confined their object to the displacing as much water as possible, and which, it seems, has only been very partially accomplished by the introduction of numerous air-cases, cylinders, &c. to the serious curtailment of the accommodation of crew and passengers.

Fearful of enlarging too much, I will now conclude, by expressing my obligation for your polite and ready attention to my communication.—Yours, &c.

WILLIAM DOBREE.

Fulham, March 16, 1831.

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CHEMICAL DISCOVERIES OF SIR HUMPHREY DAVY.

We promised, when reviewing the life of Sir Humphrey Davy, by Dr. Paris, to take an early opportunity of giving a summary of the chemical discoveries, which have immortalized his name; and the promise we now proceed to fulfil. Instead, however, of epitomizing what Dr. Paris has said on this head, we prefer compiling our summary from an admirable sketch of the "Scientific Labours and Character of Sir Humphrey Davy," which appeared in a recent number of Professor Silliman's American Journal of Science and Arts. The American writer takes upon the whole a much more comprehensive and discriminating view of Davy's chemical labours, than his English biographer.

It was in March, 1798, that Davy, then a youth of eighteen, began the study of chemistry. In only two years afterwards appeared his "Researches," a work which immediately placed him among the ablest chemists of the age. The most remarkable portion of this volume is that which relates to the properties of nitrous oxide. So fully were these properties here disclosed, that time has added scarcely any thing to their number; and few examples can be found of more thorough and successful experimental investigations, than were exhibited in these researches into the nature of a substance, at that time just introduced to the notice of the chemical world. But the merit of these analytical researches has been almost overlooked, in the astonishment that followed the discovery of the effects of nitrous oxide in *respiration*. So sudden and transforming, and sometimes indeed so appalling, are the effects produced by inhaling the "exhilirating gas," that, even now, one can hardly encounter them without some slight emotions of fear. How undaunted then must have been the spirit that first embarked on this unknown sea! How few but would have recognised the symptoms that attended the first inspirations—"the giddiness and fulness of the head," accompanied with "a loss of distinct sensation and voluntary power,"—as admonitions that they were entering a region of death! To plunge forward into the unknown abyss, revealed a spirit cased in more folds of brass than his who first braved the open sea.*

It is not the least remarkable among the circumstances of this exploit, that it was performed in the face of an hypothesis which had been proposed, founded on the deadly effects of this gas on small animals, that here was at length discovered *the principle of the plague itself.*†

The sufferings which our young philosopher voluntarily inflicted on himself, in prosecuting these researches on the respiration of the gases, remind us of Spallanzani's experiments upon the gastric juice; while the dangers he encountered carry our minds back to Pelletier, who lost his life in the audacious attempt to breathe oxymuriatic acid gas. It was deemed necessary to compare the effects of nitrous oxide with those of common stimulants, both to ascertain its relation to them, and its tendency either to increase or to diminish their effects upon the system. With this view he submitted himself to excessive intoxication, so extreme as to produce distressing and alarming symptoms.* To ascertain the effects of an atmosphere containing large portions of the same gas, he enclosed himself in a box, and at three successive intervals for an hour and a quarter (during which time he remained in the box) had sixty quarts of the gas thrown into the box, finally constituting a large proportion of the air within. When the last twenty quarts were thrown in, his emotions became similar to those usually experienced by a moderate dose of the pure gas; but not satisfied with this, immediately after coming out of his cage, he began to respire twenty quarts of unmingled nitrous oxide. As this was probably the most effectual trial ever made of this wonderful agent, the consequences are worth remarking, as detailed in the expressive terms of the adventurous experimenter.

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* Illi robur et æs triplex
Circa pectus erat, qui fragilem truci
Commisit pelago ratem
Primus.

† Researches, p. 453.

"A thrilling (he observes) extending from the chest to the extremities, was almost immediately produced. I felt a sense of tangible extension highly pleasureable in every limb; my visible impressions were dazzling and apparently magnified; I heard, distinctly, every sound in the room, and was perfectly aware of my situation. By degrees, as the pleasureable sensations increased, I lost all connections with external things; trains of vivid visible images rapidly passed through my mind, and were connected with words in such a manner, as to produce perceptions perfectly novel. I existed in a world of newly connected and newly modified ideas. I theorized; I imagined that I made discoveries. When I was awakened from this semi-delirious trance by Dr. Kinglake, who took the bag from my mouth, indignation and pride were the first feelings produced by the sight of the persons about me. My emotions were enthusiastic and sublime; and for a minute I walked round the room perfectly regardless of what was said to me. As I recovered my former state of mind, I felt an inclination to communicate the discoveries I had made during the experiment. I endeavoured to recall the ideas: they were feeble and indistinct. One collection of terms, however, presented itself; and with the most intense belief and prophetic manner, I exclaimed to Dr. Kinglake, "*Nothing exists but thoughts!—the universe is composed of impressions, ideas, pleasures, and pains!*"*

The impunity with which Davy had sustained these wonderful trials, emboldened him to attempt the respiration of the deadly gases from charcoal. His first attempt was made upon four quarts of carburetted hydrogen gas, of which he made three inspirations. "The first inspiration produced a sort of numbness and loss of feeling in the chest, and about the pectoral muscles. After the second inspiration, I lost all power of perceiving external things, and had no distinct sensation except a terrible oppression on the chest. During the third inspiration, this feeling disappeared,—I seemed sinking into annihilation, and had just power enough to drop the mouth-piece from my unclosed lips. A short interval must have passed during which I respired common air before the objects about me were distinguishable. On recollecting myself, I faintly articulated, *I do not think I shall die.* Putting my finger on my wrist, I found my pulse thread-like and beating with excessive quickness." Extreme giddiness, loss of memory, and numbness succeeded, with excruciating pain in the forehead and between the eyes, with transient pains in the chest and extremities.

(To be continued.)

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* Researches, p. 481.

* Researches, p. 487.

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INTERIM NOTICES.

Communications received from Mr. Busby—T. M. B.—Mr. Stephens—T.—Mr. Baddeley—Mr. Dousberry—Mr. Fowler—A Young Simpleton—Hezron—S. A. W.—J. G.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

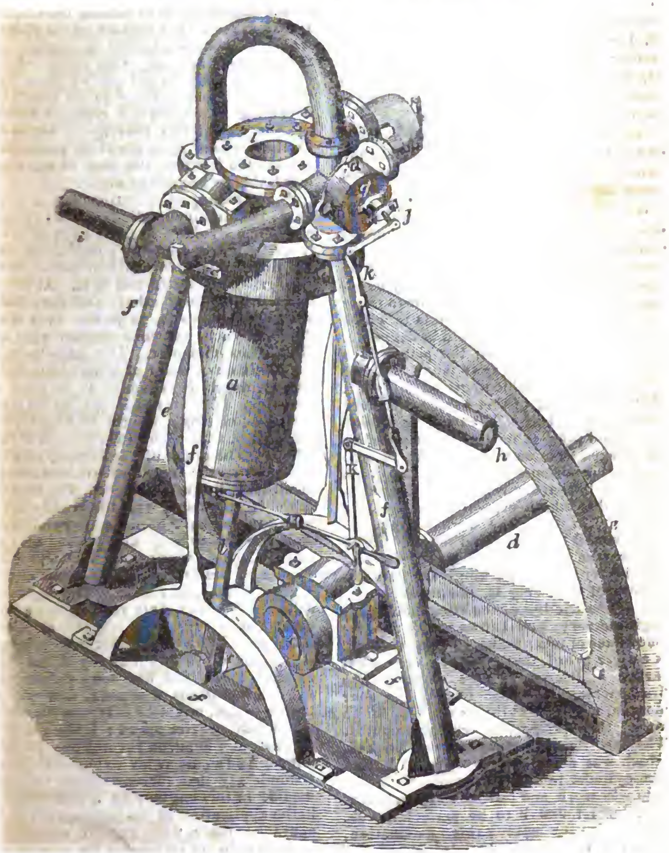
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 398.] SATURDAY, MARCH 26, 1831. [Price 3*d.*

LESTER'S PENDULUM STEAM-ENGINE.



LESTER'S PENDULUM STEAM-ENGINE.

The engraving on the preceding page represents a steam-engine of a very novel construction, which is now to be seen at work in the Navy Yard at Charlestown, Massachusetts, and has been in daily use there for upwards of two years. It is called, from the swinging motion given to the cylinder, the pendulum-engine, and is the invention of Mr. E. A. Lester, of Boston (U. S.). A represents the cylinder; B, the piston-rod; C, the crank; D, the shaft; E, the fly-wheel; F, the frame; G, the steam-chest and valve; H, the induction-pipe; I, the eduction-pipe; J, the valve-stem; K, the valve-gear; and, L, the cylinder-cap.

The following very satisfactory account of the working of this engine is from the pen of Mr. Noah Butts, the Engineer of the Charlestown Navy Yard:—

"I have seen this engine ever since it was put up, and it has been running pretty much all the time, day and night; it has run about two-thirds of each twenty-four hours; and I have found, from my experience, that the engine is superior to those on the old plan, in those points in which I, at first, supposed it would be defective. There is less friction on the piston; the packing does not wear so much, and the engine is not so liable to get out of order. The last packing of this engine run seven months and a half. The packing of one on the old plan is commonly required to be changed from once a fortnight to once a month, and more frequently in a high than in a low-pressure engine. I am confident, that a high-pressure engine on the old plan, in doing the work of this engine, would have required the packing to be renewed, at least once in three weeks. The injury to the packing, and the frequency of renewing it, is one important test of the friction of the engine, as every engineer very well knows; and the circumstance of this packing running so long, is a clear proof, that there is a very great saving of friction in this engine. The first packing ever put into it run four months, when the cylinder was in a rough state; the next packing run six months. The last time this engine was packed, which was about six weeks ago, I tried the cylinder to ascertain whether the inside was worn, and how it was worn, if at all; but I found it to be perfectly true. The reason for making this examination, was, that it had been said, as I was told, that the inside of the cylinder of an engine upon this plan would wear oval; I was accordingly induced to examine this engine particularly, as above stated, and found it not to be worn in the last out of true. I think one very great superiority of this engine is, the advantage the construction gives for passing the dead centre, which it passes with more ease and power, so that it will have a greater effect on the crank, and operate with a greater power, than one on the old plan, of the same size, and with the same force of steam. This advantage is derived partly from the assistance that the weight of the engine gives in passing the centre. It also saves all the friction of the slides, which cannot be avoided in engines on the old construction. One reason of its being less liable to get out of order, is, that there is no gearing to be used between the piston-rod and crank, whereas the gearing of this description required by the engines, upon the other plans, increases the friction, and also is more or less liable to get out of order.

"The engine in operation in this navy yard, is a nine-inch cylinder, of a twenty-eight inch stroke. The work required of it varies; it is used for pumping out the dry-dock, and also has four lathes, and two grindstones attached to it. At times it has driven these lathes, and the grindstones, and two large pumps of a foot diameter each, and four smaller ones of six inches diameter. The large pumps lift a column of water of about forty feet, and the weight is estimated to be about a ton each. The four smaller ones lift sixteen feet, making a weight of about two hundred pounds each, 4800 pounds in the whole. The crank of the engine, as will appear from the length of stroke already mentioned, is fourteen inches. The strokes of the large pumps, with the cranks heretofore in use, have been thirty-two inches and three quarters, and those of the smaller ones twenty-four inches. The strokes of the pumps are to those of the engine, in time, as 7 to 25. The engine is calculated to run sixty revolutions a minute, and is ordinarily worked at about that rate. With the present boiler, being a cylinder of 18 feet long by 3 feet diameter,* the engine has been driven seventy revolutions a minute, and with a larger boiler, might be driven with safety at a much greater speed; I should say, at least, at a hundred revolutions per minute. And as far as my experience goes, I should say that increasing the velocity would, in this engine, be a greater gain in the application of the power, that is, it could be made with greater economy; and the gain by increasing the power, by an increase of the velocity, is, I am confident, greater in this engine than in those of the old construction. The lathes above mentioned are used for turning iron and wood.

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* The engine is ordinarily operated with steam power, 20 to 30lbs. per inch, and occasionally at 35lbs. per inch.

"Since this engine has been in operation, not one dollar has been laid out in repairs upon it."

We have also before us a pamphlet in illustration of the merits of the engine by the inventor himself, from which we make the following extracts:—

"One advantage of the pendulum-engine is obvious, namely, the application of the power by connecting the piston-rod immediately with the crank-pin. Here the lever-beam, connecting-rod, and all the gearing apparatus of whatever kind, interposed between the piston-rod and crank-pin, in fixed engines of all descriptions, is at once dispensed with. And, then, this gearing or intermediate machinery, in some fixed engines, as for instance an engine standing on end, and working upwards by a connecting-rod, constantly opposes the motion of the crank, by its gravity, except at the dead points, when the connecting-rod is precisely perpendicular. The resistance from this cause is not great, but whatever it may be, it is saved in the pendulum-engine. Again, this intermediate gearing is liable to friction, which is a constant impediment that must be overcome by a constant expenditure of power for this purpose. By considering how much power would be requisite to keep this intermediate gearing and machinery of a fixed engine in motion, precisely as it moves when the engine is in operation, some estimate may be formed of the saving of power, made in this particular, by the pendulum-engine. This single advantage of that engine, unless it is offset by some important disadvantage, will, the inventor apprehends, be a sufficient ground for a decided preference of it.

"Another advantage of the pendulum-engine, is, that in the motion given to it, in operation, the weight assists in passing the dead points, that is, the two points at which the crank is parallel with the piston-rod. I do not know of any engine upon any other plan, which, by its own intrinsic motion and operation, assists itself over these points by the mere action of gravity. On the contrary, in engines of a different construction, gravity, as far as it acts at all, more frequently acts as an impediment to the operation of the engine.

"In the pendulum-engine, the whole weight of the cylinder, piston, and piston-rod are kept in motion, and on the first glance at the machine, the idea has occurred to some machinists, that considerable power must be expended in keeping this weight in motion, and thus lost. They confound the principle of the construction of this engine with that of one suspended in the middle, so as to balance itself, which has mostly gone out of use, and the objections to which will, I think, serve to illustrate the advantages of the pendulum-engine in regard to the action of gravity. The balanced engine, when put in motion, like all other bodies in this respect, has a tendency to continue the motion, and the greater the velocity is, the greater will be this tendency. Accordingly, when it comes to the extreme position, by the motion of the crank, the momentum it has acquired tends to an entire revolution of the cylinder, in opposition to the movement of the crank, and the result of these two contending powers of steam and gravity, is the bending or breaking of the piston-rod. It will, as it appears to me, be obvious, upon the slightest consideration, that the pendulum-engine is not theoretically liable to any such difficulty, and that it is not practically so, is, I think, very satisfactorily proved. As a pendulum of about 39 1-8 inches vibrates seconds, a pendulum-engine of which, with the piston and piston-rod, the centre of oscillation is at a distance of 39 1-8 inches from the centre of motion, that is, the centre of the gudgeons, will, when put in motion, tend, by the force of gravity, to vibrate seconds; and that, whether the arc in which it vibrates be a greater or smaller part of a circle—if we throw out of consideration, as we will for the present purpose, the difference between the vibrations of a pendulum in the arc of a circle and in a cycloid—and it will continue to vibrate seconds, if power enough is applied merely to overcome the friction on the gudgeons, and the resistance of the atmosphere, which latter may be thrown entirely out of the question. As to the friction on the gudgeons and at the joints of the steam-pipe, it is only a substitute for that of the joints of the connecting-rod of a fixed engine, and is much less than that; for I find, by experience, that there is very little wear at the gudgeons of the pendulum-engine, which will run a long time before the boxes need to be screwed up, whereas the joints of the connecting-rod of a fixed engine are subject to great wear, and require to be frequently adjusted. I am at least safe in assuming that the friction at the gudgeons and joints of the steam-pipe, in the pendulum-engine, is not greater than that of the joints of the connecting-rod of a fixed engine; and since the former is a substitute for the latter, there is at least no loss in this respect in the pendulum-engine. For the present purpose, then, we will assume this friction of the two species of engines to be exactly equal, and throw it out of the question in making the comparison between the two, in relation to the effect of the gravity of the cylinder and piston and piston-rod on the operation of the pendulum-engine. In regard to gravity, the cylinder of the pendulum-engine will represent a pendulum of a little less than two-thirds of the length of the cylinder of the engine, so that a pendulum-engine, of which the cylinder is four and a half feet in length, will, as far as gravity and oscillation are concerned, represent a pendulum of 30 to 36 inches in length. As such a pendulum vibrates seconds, it follows that an engine of which the cylinder is four feet and a half in length, will perform 30 to 35 revolutions in a minute, without the least disturbance or impediment from its gravity; and an engine, of which the cylinder is twenty-seven inches in length, will perform somewhere about 50 or 60 revolutions a minute, without any obstruction from this cause. To this degree there can be no question that gravity concurs perfectly with the motion of the cylinder of the pendulum-engine. But it appears from the facts stated in relation to the engines already in operation, that it may be run at double this velocity at least, to advantage. The engineer of the pendulum-engine at the Navy Yard in Charlestown, from observing the action of the engine, estimates that it might be advantageously driven a hundred revolutions a minute.—This allows of a greater velocity than that at which a fixed engine can be driven without endangering its gearing.

"It is, then, one of the advantages of the pendulum-engine, within the ordinary proportions of length and diameter of cylinder, that, by dispensing with gearing, it admits of being run with greater velocity than a fixed engine of similar proportions, and the influence of gravity, instead of hindering, rather favours its being driven with such greater velocity.

"But the other advantage arising from the influence of gravity upon the action of the pendulum-engine in helping the crank over the dead points, will be considered by many persons as more important. This influence of gravity, which is constantly maintained by nature, and costs no fuel, gives the greatest momentum at the two dead points of the circle of the crank, precisely where it is wanted, and it affords this assistance without any loss or sacrifice, at any other points, for this purpose; being an assistance spontaneously arising from the intrinsic principles of the operation of the machine.

"Considering the concurrence of the action of gravity with the motion of the cylinder, I think it will follow, that the largest engine may be constructed on the pendulum principle, without the slightest obstruction from its gravity.

"Every circumstance in the effect of gravity accords with, and facilitates, the operation of the pendulum-engine. Thus, if the revolutions of the shaft, and consequently the balance-wheel and crank-pin, are perfectly uniform and regular, the cylinder must swing quicker when the crank-pin is in the upper part of the circle described by it, because the distance from the centre of motion, that is, from the gudgeons to the crank-pin, is then shorter (the distance which the crank-pin traverses in its circle, from one extreme of the vibration of the cylinder to the other, being less) than when the crank-pin is in the lower part of its circle, and the cylinder is making its vibrations between the same extremes in that part.—In order to accommodate the influence of gravity to this circumstance, the pendulum should be shorter, when the crank-pin is in the upper part of its circle. Now, this is precisely the fact, for when the crank-pin is in the upper part of its circle, the piston and piston-rod are withdrawn towards the upper part of the cylinder, and thus the weight, being drawn up towards the centre of motion in this part of the revolution, gives a shorter pendulum, and thus adapts the action of gravity more exactly to the regular motion of the crank.

"A perfect coincidence in the motion of the pendulum and crank-pin, occurs in one other respect. The pendulum moves slowest towards the extremes of its vibrations; and the *horizontal* motion of the crank-pin across the circle described by it, supposing the crank to revolve uniformly, precisely corresponds to this motion of the pendulum: that is, if a perpendicular line be drawn through the crank-pin, and move with it, this line, as the crank moves uniformly in its circle, will pass over its horizontal diameter at each vibration, that is, twice in each revolution of the crank, and it will pass more rapidly over the part near the centre and more slowly over the extreme parts. Thus we see that the action of gravity in the vibration of the pendulum, and the motions of the crank-pin in the uniform revolution of the crank, accord and harmonize with each other in all particulars.—From these causes arise that beauty and facility in the motion of this machine, which have been remarked upon by many persons who have witnessed its operation.

"Another advantage in the plan and construction of this engine, remaining to be mentioned, arises from its working in a frame, the parts of which always maintain the same relation to each other; and, as it has in its operation no tendency to displace any fixtures, or disturb the foundation, a great expense is saved in these respects, in putting up the engine, more especially in places where it is difficult to get a good foundation. The pendulum-engine only requires a foundation sufficient merely to support the *weight*, without any necessity of providing for extraneous resistance to the action of the machine itself, as in the case of a fixed engine."

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CHEMICAL DISCOVERIES OF SIR HUMPHREY DAVY.

(Continued from our last.)

In the experiments, related in our last Number, it is evident that Davy narrowly escaped being numbered among the early martyrs of science. He has finally died of apoplexy; and we can scarcely refrain from believing that his constitution, which was so vigorous in youth, withered and decayed long before it reached old age, from the effects of these early injuries; like some tree of noble growth, which fades and casts its leaves, ere it reaches the autumn, in consequence of wounds inflicted while in its vernal bloom.

Knowledge is proverbially quiet and serene; and little has been either said or thought of the heroism of men of science. But they sometimes encounter dangers as real as those which are braved in the field of battle or on the stormy deep; and, we may venture to add, with a spirit as fearless as that of the warrior or the navigator. Even the alchymists groped their way amid tremendous elements, which (in some mysterious manner they were unable to explain) not unfrequently gave them most durable proofs of the energies of the powers of nature. A lost eye, a dismembered limb, or a scorched and crisped visage, bore frequent testimony of the conflicts they had carried on with the powers of darkness. If men of science have now learned to controul these ordinary dangers, they have encountered others still of a no less formidable character. Some have ascended the air in balloons; others have climbed to heights to which the eagle never soars; others have braved the terrors of a polar winter; some have descended into the fiery craters of volcanoes; and some have waged war with the lightning of heaven.

In 1802, Davy delivered a course of lectures on Chemistry to the Board of Agriculture. The principal objects which he proposed to himself were, first, to ascertain *the food of plants*, and hence to learn the best method of supplying it; secondly, to investigate *the nature of different soils*, and thus to detect the latent causes of productiveness or sterility, with the view of promoting the one and applying the proper remedy to the other; and thirdly, to examine *the nature of manures*, for the purpose of augmenting their fertilizing powers, preventing their waste, and multiplying their number and variety. We regard his efforts as having been by far the most successful on the last point. Inquiries respecting the food of plants, connected as they are with the functions of living vegetables, belong rather to physiology than to chemistry; the method of deciding on the qualities of a soil, from the knowledge of its constituent principles, is too refined for the simple art of husbandry; but since manures undergo various chemical changes, and owe their peculiar properties to these changes, they present inquiries which are strictly chemical, and which none but the chemist can satisfactorily answer. Had Davy, by his agricultural inquiries, ascertained nothing more than that the most fertilizing portions of many of the best manures, are likewise the most volatile, and had he done nothing more than furnish the rules which he established to prevent the waste of these portions, he would have conferred a benefit upon agriculture of the greatest importance. Although treatises had previously been written with the view of reducing several branches of husbandry to a science, yet the Agricultural Chemistry of Sir Humphrey Davy was the first, and continues to be the last work, that presents to the agriculturist a digested code of laws constituting the scientific principles of his art. Many of the members of the Board of Agriculture were practically acquainted with farming; and the high authority conceded to this work, not only by them but by all enlightened agriculturists, is a sufficient proof of the soundness of its doctrines, and its freedom from all visionary hypotheses, incompatible with experience. Considering that, when he commenced this course of lectures he was only twenty-two years of age, and had not been bred on the farm, but had spent his life chiefly with books and in the laboratory, we cannot but admire the facility with which he adapted himself to the circumstances of the practical agriculturist; and we recognize in him, as in Franklin, an uncommon union of the philosopher with the man of strong common sense.

In 1806 and 1807, he made his brilliant discoveries in Galvanism. The discovery of the metallic bases of the fixed alkalies, which has led also to the knowledge of the composition of the earths, was one of the most important discoveries hitherto made in chemistry, and deservedly ranks with the discovery of carbonic acid by Dr. Black, of oxygen gas by Dr. Priestley, and of the composition of water by Mr. Cavendish. Some men of intelligence, however, not particularly conversant with chemical science, have expressed to us their inability to comprehend the reason why so much importance has been attached to the galvanic discoveries of Davy, or why they have been rewarded with such unbounded applause? To evolve from a piece of potash a metallic globule, seems too inconsiderable a matter to deserve the popularity with which the achievement has been rewarded. But they do not reflect, that it is one of the peculiarities of chemical analysis, that discoveries made with the minutest quantities of bodies often lead to the grandest conclusions. Thus a drop of water was no sooner resolved into its constituent elements, oxygen and hydrogen, than a new flood of light beamed forth upon the world; not only displaying to the mind, in a new and more interesting view, the expanse of waters, but revealing at once the cause of innumerable phenomena of chemistry which depend on the agencies of water, and disclosing the mysterious constitution of the vegetable kingdom. In like manner, the knowledge of the composition of a particle of potash, conducted us to a knowledge of the elementary constitution of the solid globe itself. To pass by the remarkable and brilliant physical properties of potassium, it became, moreover, in its turn, a most powerful auxiliary in investigating the composition of many other bodies; for, it was its strong affinity for oxygen, the strongest possessed by any known body, that had enabled it, under all previous trials, to disguise its metallic nature; but this oxygen being withdrawn from it, potassium itself now became a powerful agent of analysis, appropriating to itself, as it does, the oxygen of every other substance that contains it.

The year 1810 marks another great epoch in the life of Sir Humphrey Davy. It was during this year that he brought forward his theory respecting the nature of chlorine, or oxy-muriatic acid, which gave rise to the memorable controversy on this subject, that agitated the schools of chemistry during the ten following years. At the commencement of this period, our philosopher saw himself standing alone, with the whole army of chemists arrayed against him; at the close of it, he had the satisfaction of seeing nearly all of them on his side.

To enable such of our readers as may not have had opportunity to understand the nature of this controversy, it may be mentioned, that the great Swedish chemist, Scheele, who discovered chlorine, supposed it to be muriatic acid deprived of its inflammable principle, and hence denominated it *dephlogisticated marine acid*. This was in the year 1774. In 1785, Berthollet, one of the most distinguished of the French chemists, afterwards subjected this substance to numerous experiments, and concluded it to be a compound of muriatic acid and oxygen, and hence named it *oxy-muriatic acid*. In 1809, Gay-Lussac and Thenard published a number of experiments on it, in which they intimated the possibility that it was a simple body, although they adhered to the opinion of Berthollet. Such was the state of opinion respecting oxy-muriatic acid, when Davy began his experiments upon it in 1810. These led him to adopt and publicly to assert the opinion, that oxy-muriatic acid, (or *chlorine** as he proposed to call it,) is a simple body, analogous in many of its properties and relations to oxygen; and that muriatic-acid itself is a compound of chlorine and hydrogen, as sulphuric acid is a compound of oxygen and sulphur.

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* A new name obviously became necessary, because the name *oxy-muriatic acid* implied that it was an acid, and that it was composed of oxygen and

The simple enunciation of this doctrine does not indicate to those who are but little acquainted with chemical science, the reasons why chemists have attached so much importance to it; nor would they, perhaps, consider it as a point worth disputing about, *whether chlorine is a simple or a compound body.* But two consequences resulted from the doctrine asserted by Davy, which went to subvert the very pillars of chemical science, although they were supposed to be immovably fixed by Lavoisier. For if chlorine contained no oxygen, but is, like that, an independent supporter of combustion, and like that also is capable of forming acids with combustible bases, then the doctrines of combustion and acidification established by Lavoisier, must be given up, since here is a case in which combustion and acidification both take place without the presence of oxygen. A single experiment which is found to be incompatible with a received doctrine, is frequently sufficient entirely to subvert that doctrine; and such were the experiments in question. They required a great part of the philosophy of chemistry to be remodelled, and its nomenclature to be changed. Lavoisier's definition of combustion, "the combination of oxygen with a combusbustible base," could no longer be admitted, but a new classification was to be instituted, comprehending not only those cases of combustion which depend on the agency of oxygen, but those also which depend on the agency of chlorine, and other analogous bodies which might afterwards be discovered.

Now, combustion and acidification are processes of such extent, and are concerned in so many of the chemical changes which bodies undergo, that any new theory which alters the explanation of these phenomena, affects in a great degree the whole philosophy of chemistry. It is by the *relations* which a body sustains to chemical agents, and especially to caloric and oxygen, that its chemical nature is determined. Hence, a complete history of the properties of almost any substance, *in all its relations*, involves an application of nearly all the leading principles of the science.—Scheele wrote an essay on manganese, in which, after the labour of three years, he unfolded most of the properties of that substance, many of which had been before unknown. During his experiments on manganese, he discovered both oxygen and chlorine, and learned the most important properties of these extensive agents. The selection of manganese, as a subject for experimental research, was in some respects fortunate; but had Scheele investigated the properties of several other substances, with the same persevering attention and singular acuteness, he would have made the same discoveries. In like manner, to settle all the relations of chlorine to various chemical agents, must involve an application of nearly all the leading principles of chemical science; and to ascertain, as Davy did, that chlorine had properties and relations which could not be explained in accordance with existing theories, was to prove that these theories were either defective or erroneous, and were therefore to be either limited or discarded.

But it was not merely on account of the reformation which these views of the nature and relations of chlorine carried into the science of chemistry, that they have contributed to the advancement of that science. As is common in able controversies, every corner of the science was hunted for arguments in favour of one hypothesis or the other; new discoveries were made incidentally; and various facts before known, were more fully confirmed and illustrated.

The *manner in which this great controversy was conducted* between Sir Humphrey Davy and Mr. Murray of Edinburgh, is worthy of being particularly remarked. It is rare in any debate to find the parties so well matched, and both so able. Davy and Murray were both ingenious and accurate experimenters, and equally acute and logical reasoners. They were both gentlemen; and exhibited throughout this protracted discussion, a rare example of courtesy and good temper. Each had the right kind of obstinacy;—not a determination to persist in error, but that perseverance which is founded on a strong conviction

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muriatic acid, both of which positions were now in controversy.

of the truth, and which produces a corresponding determination to support it. Davy had great obstacles to overcome. The opinions of the chemical world were made up and settled on this point, and settled against him. Several of the leading chemists of the day had "made their book," and had thus entered into bonds with society to support the prevailing doctrine. Chemists also being familiar with the explanations made on the old theory, for that reason imagined them to be much *simpler* than the explanations proposed. It generally happens, in warm and protracted disputes, that each of the parties is apt to think that the reason why his opponents do not see his opinions to be true and incontrovertible, is owing either to their obstinacy or want of penetration. Hence he is prone to regard his antagonists with resentment or contempt; not to *see* things so plain, argues stupidity; not to *acknowledge* what they cannot but see, argues wilful obstinacy. We have not been able to find anything of this temper in any of the controversial writings of Sir Humphrey Davy.

Between Mr. Murray and Dr. John Davy there was, however, at one time a little jarring. The doctor, after proving as he thought the insufficiency of one of Mr. Murray's arguments, adds, in a tone which savours a little of haughtiness, "After the preceding statement of facts, Mr. Murray, I should conceive, will be induced to renounce his conclusion; and I should likewise imagine, that this gentlemen in future will be more cautious in his assertions and criticisms on the labours of others."* Mr. Murray, in his next paper, shows that Dr. Davy had admitted the *fact* in controversy which he had before steadily denied; and that what the doctor had advanced to account for it in conformity with his theory, was a series of hypotheses unsupported by proofs, and then adds,—"he therefore, I trust, will in future be more cautious in his assertions, and in calling in question the results of the experiments of others."†

But we are not aware that Sir Humphrey Davy was ever betrayed into any want of courtesy, although he was assailed at different times by Gay-Lussac and Thenard, by Dalton, by Murray, by Berzelius, and by many others. Nor have the records of science often exhibited such uniform modesty, in the pretensions of those who have extended its boundaries. When the occasion calls upon him to allude to his own discoveries, he speaks of them as things which *he had the good fortune to discover.* When circumstances demand the application of a new name, as that of chlorine, his language is, *after consulting several eminent men, I have ventured to propose this name.* It was probably this modesty in asserting his claims, (so characteristic of true greatness,) this respectful regard to the feelings and rights of others, which has made the world so freely acquiesce in his praises, and preserved him from that envy, which is so apt to be displayed towards eminent cotemporaries.

(To be concluded in our next.)

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LOCOMOTION—SAXULA'S THEORY.

Sir,—Passing along Thames-street the other day, I noticed a man endeavouring to back a horse and cart heavily laden, into a yard; this, however, he could not directly accomplish, in consequence of the load being too much for the horse. The driver, having no doubt the advice of Hercules before his eyes, applied his strength to the wheel, by laying hold of the spokes near the circumference, an assistant doing the same at the other wheel, and the difficulty was instantly overcome; the cart being run back with comparatively but little exertion on the part of the horse.

I have frequently seen, and so perhaps have many of your correspondents, the same thing done on many occasions, without giving the circumstance a single thought; upon the present occasion, however, I was forcibly reminded of Saxula's new theory of locomotion, and the wheel-barrow problem, at page 191 of your last volume.

It is a common practice in the inn-yards, when the men want to move a stage-coach from one part to another, for one man to propel it by turning one of the hind wheels, while another guides it by means of the pole; and, although I cannot myself pretend to draw a mail-coach, yet I can propel one with considerable facility, by applying my strength to the wheel in the manner stated.—Again, in a common truck, with a wheel

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* Nicholson's Journal, XXXIX. 32.

† Nicholson's Journal, XXX. 230.

4 or 4½ feet diameter, I can turn round a man at the handle, notwithstanding his endeavour exerted favourably on a long lever to prevent it, by seizing the extremity of the spokes of one of the wheels.

Without going the full length of Saxula's argument, yet I am decidedly of opinion that there is a principle involved in the simple illustration adduced by that writer, which persons interested in the subject of locomotion, will do well to investigate; and that, although great difficulties may arise in reducing locomotive principles to practice, yet the mechanical application will be greatly facilitated, when the *principles* are more correctly and more generally understood.

Wm. Baddeley.

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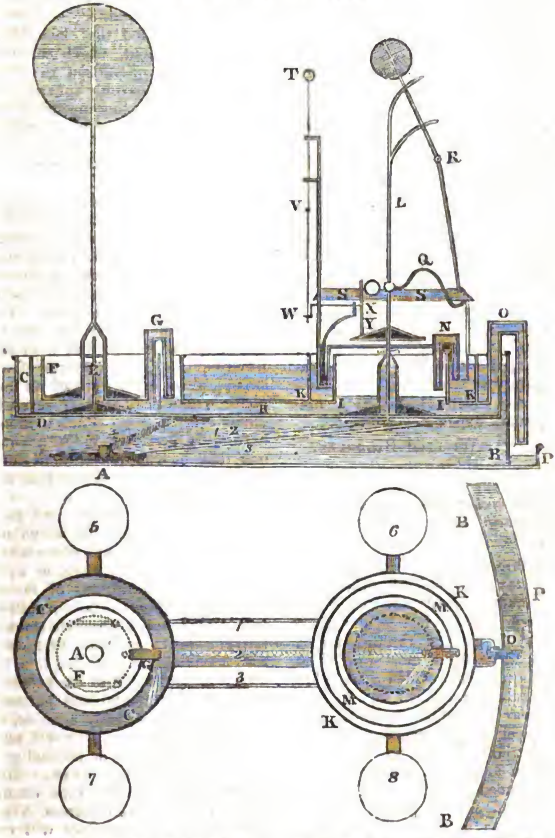
BUSBY'S HYDRAULIC ORRERY.



Sir,—On referring to the 40th volume of the Transactions of the Society of Arts, I find that I have indeed "entertained an inaccurate idea of some of the peculiar characteristics of the Busby orrery" (see Mech. Mag. vol. xiv. p. 443.)

An orrery something similar to that described in No. 382 of this work, was exhibited to the Members of the London Mechanics' Institution, as the Busby orrery, by Mr. Partington, in a lecture delivered in August, 1825; and I have since found it described in the 2nd volume of the Lond. Mech. Register, p. 292.

The impression on my mind was, that Mr. Busby was the author of applying a syphon to the production of motion on the principle of Barker's mill, without knowing the beautiful and extensive application which he had made of the power thus generated.

While I plead guilty of *concealment*, I must deny the charge brought against me, of *misrepresentation;* in fact, the charge itself goes towards exculpating me, rather than otherwise. In conclusion, I would wish to state, that, in the hydraulic orrery, for which the Society of Arts awarded Mr. Busby their Gold Vulcan Medal, the arrangements are so ingenious, and the effects produced so magnificent, that I feel great pleasure in transmitting the inclosed description, for insertion in your pages, in compliance with the wish of the inventor, and also from a conviction that the perusal will prove highly interesting to your numerous readers; the simplicity of the apparatus is such, that any mechanic of ordinary skill may construct one, at a comparatively small expense.—Yours, &c.

William Baddeley.

Explanation of the Motive Principle of the Hydraulic Orrery. By Mr. C. A. Busby.

" About three years ago I was engaged, during my stay at New York, in a course of experiments to determine the resistance opposed to solid bodies of various forms, in their passage through fluids. To perform these in the most simple and effectual manner, I provided a large basin or circular reservoir, and placed therein, near the circumference, any floating vessel that happened to be the subject of trial. This vessel was connected by an arbor to a floating centre, held in its place by a small shaft passing through it, and erected perpendicularly from the bottom of the reservoir. The bottom of the floating-vessel was pierced, and a syphon, which it carried, being soldered into the aperture, rose from it, and extending over the circumference of the reservoir, its other extremity depended in air, at a lower level than the surface of the water.* This outer leg of the syphon was closed at the bottom; but a minute lateral aperture, resembling a very small finger-hole of a flute, being made, the water spouted through it (when the syphon was charged) in a direction parallel to the vessel, which instantly began to move with accelerated velocity in an opposite course. In a few seconds, a maximum was obtained, and the future progress exhibited that beautiful, continuous movement, which can only find an adequate comparison in the silent gliding of the heavenly spheres.

" The idea instantaneously impressed me, and has been subsequently embodied, with the most encouraging success, in the novel machine above mentioned.

" At present I have applied the principle, under appropriate modifications, no further than to the Sun, the Earth, and the Moon, whose circuits, obliquities, parallelisms, and rotations, are displayed in apparently spontaneous movements, on an area of five feet diameter. To effect these, three floating-syphons are so combined in succession, that a quantity of water equal to the discharge of a single stream, about one-eighth of an inch diameter, with a head of about seven inches, elicits every action. Each motion, as in nature, is perfectly independent; any one may be checked without impeding another; and when the hydraulic orrery commences its operations, it practically illustrates those incipient and gradually accelerating movements, which may be supposed to have taken place within the mighty system itself, when, as in the beginning, the maximums of the greater motions were probably attained in succession. This motive principle (founded on Barker's mill, but now first combined with a syphon, and applied to a floating body) is applicable to an extensive variety of experimental and philosophical purposes. It is so truly equable, that by means of it I make the novel and interesting experiment, of producing a perfect hydroparabolic mirror fifty-four inches diameter, and thus create any magnifying power *ad libitum*. Whirling-tables upon this principle will preserve any particular velocity, during any required period of time, and the motion permits the most minute regulation, either by a variation in the length of the syphon, or of the size of the discharging-aperture; or by so fixing a small flexible inclined plane to the syphon itself, and bending it into the stream, as that any proportion of its re-action may be neutralized by its action. Another mean of obtaining an universal standard of measure is hereby provided independently of the pendulum. Thus a given parabolic speculum will invariably be formed by any given rotation at any known level and latitude, and the focal distance of any parabola must, under those circumstances be always a given dimension. A graduated revolving circle will also practically measure such minute portions of time as are beyond the recognition of the most accurate astronomical clocks. The hydraulic orrery, when in action, lowers the surface of the water upon which it floats, about one inch in an hour; it is effectually stopped by blowing air into the syphons, or by preventing the efflux of water in any other manner."

Description.

The prefixed engraving represents the plan and section of the apparatus; the same letters are used to point out the corresponding parts of figs. 1 and 2.

" There must first be imagined a circular reservoir 5 feet diameter, of which A is the centre, and BB parts of the circumference; CC is a circular gutter (11 inches external and 9 inches internal diameter) floating concentrically in the reservoir; D is a bar fixed diametrically across the bottom of the inner circle formed by the gutter CC; from the middle of this bar a small shaft E is erected; FF is a cylindrical floating-vessel 8½ inches diameter, a tube is soldered into an opening (1 inch diameter) in the centre; the top of this tube is closed, except a small hole through which the shaft E passes, and acts as a pivot; a cap covers the central tube, and terminates in a rod surmounted by a ball (9 inches diameter), representing the Sun; G is a syphon soldered into an aperture in the floating-cylinder FF, and balanced by a weight on the opposite side; the other leg of this syphon hangs over into the circular-gutter CC, into which it discharges a minute *lateral* stream of water, the re-action of which stream gives a rotatory motion to the vessel FF, and consequently to the ball which it carries. The water discharged into the gutter CC passes away through the tube H, beneath the surface of the great reservoir, and enters the floating cylindrical chamber II; this chamber (8 inches diameter) is surrounded with a second cylinder KK, 11 inches diameter, but the water of the great reservoir is admitted through large apertures beneath into the intervening space. In the centre of the chamber II, a tube one inch diameter is erected, closed above and below, except small central openings through which the shaft L passes, ultimately bearing a 3-inch ball representing the Earth. In the circular space between the cylinders II and KK floats a ring MM, a bar extends diametrically across the upper part of this floating-ring, and the shaft L acts as its pivot through a central opening. Upon this ring is erected a small shaft bearing a ¾-inch ball representing the Moon.

" On an opposite part of the ring, one leg of a syphon is soldered into an aperture, while the other leg hangs over into the chamber II, into the lower part of which it discharges a small stream *laterally;* the re-active force of this stream causes the ring to revolve, and, consequently, to carry the ball representing the Moon round that by which the Earth is designated. The water now brought into the chamber II, by the two syphons which move the balls representing the Sun and Moon, is carried away by a great syphon O, communicating with it by a short horizontal tube; this water is discharged *laterally* at a lower level from the great syphon into an external gutter P, placed to receive it, and its re-active impulse gives motion to the whole apparatus, and causes it to perform a circuit in the great reservoir, representing the annual orbits of the Moon and Earth about the Sun. The parallelism of the Earth's axis is effected by fixing a circular-plate (6 inches diameter) to the lower extremity of the rod L, and connecting its circumference by three equal oblique rods 1, 2, 3, with that of another circular-plate fixed to the centre of the bottom of the reservoir; thus is formed a sort of circular parallel rule, which produces the desired effect; the lateral confinement of the central part of the apparatus being effected by means of the inclined forked brace 4, shaped like a spur, and clasping the fixed plate, itself being fixed to the inner extremity of the tube H upon a hinge incapable of lateral action. The longer arm of the steel-yard Q (attached to the shaft L, and moveable on a vertical joint) sustains the lower extremity of a slender rod, connected by an universal joint R with the axis of the 3-inch globe, a small wheel is fixed upon this rod towards the lower end, and the conical rim SS, borne by, and revolving with, the circular-shaft which carries the Moon, acts upon the little wheel by contact with the edge, gives it a rotory motion, communicated immediately through the universal joint to the globe above, while the shorter arm of the steel-yard is balanced by a weight just sufficient to keep the wheel slightly pressed against the rim.

"The obliquity of the Moon's path is imitated, by causing the auxiliary rod sustaining the smallest ball to slide up and down through two projections from the main standard as she revolves; this is effected by making a joint at V, and attaching the lower extremity to a revolving-crank W, this crank is fixed to the continued axle of a thin vertical wheel X, rolling on the horizontal circle Y, which is itself fixed to, and borne by, the shaft supporting the Earth. The change of the Moon's nodes is performed by making a due variation between the diameter of the vertical wheel and that of the circle on which it rolls. The four balancers (5, 6, 7, 8) are added, for the purpose of keeping the apparatus steady, by a necessary extension of the floating base."—*Transactions of the Society of Arts*, vol. xl. p. 99.

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PROGRESS OF THE RAILWAY SYSTEM IN AMERICA.

1. *Railways completed.*

	Miles long.	Cost per mile.	Track.
Manchester	13		Single
Quincy	3	*dls.* 11,000	Single
Mauch Chunk	9	3,050	Single
Schuylkill	13	7,000	Double
Mill Creek	4	3,500	Single
Mount Carbon	9	11,000	Double
Schuylkill Valley	10	5,500	Double
Lateral, intersecting ditto	13	2,600	Single
West Branch	15	10,000	Double
Laterals for ditto	5	2,000	Single
Lackawaxen	16	12,000 including engines and other appendage.	
	110		

2. *Railways in progress.*

	Miles long.	Estimated cost.
Albany and Schenectady	18	
Camden and Amboy	65	
Columbia	84	*dls.* 15,000
Allegany	38	25,000
Lakens Valley	16	
Little Schuylkill	18	
NewCastle & French Town	16	
Petersburgh & Roanoke	60	
Baltimore & Ohio	340	22,000
Baltimore and Susquehanna	60	
Charleston and Hamburgh	150	6,500
Lexington and Ohio	80	
Detroit and Pontiac	25	
Louisiana	4	

Total, 974 miles.

The longest of these Railways—the Baltimore and Ohio—was commenced two years since. The following remarks on the manner of its construction, we extract from the communication of a correspondent of the Boston Mechanics' Magazine:—

"The first thirteen miles to Ellicott's Mills is finished with a double track. A single track is laid down twelve miles further, and the whole line to the valley of the Potomack (upwards of sixty miles,) is in progress, and expected to be completed by the end of the ensuing year, and fifty miles per annum, until the whole is completed.

"The actual cost for gradation and masonry, of the first thirteen miles, was more than 46,000 dollars per mile. It was expected that this would be the most expensive part of the route, but nothing like what has been incurred.

"In consequence of a change in the location of this part of the road, a very great increase in the amount of excavation and embankment was rendered necessary. Substituting stone for wooden bridges, and finishing them in a style of elegance altogether incompatible with the dictates of that economy which is indispensable to the successful prosecution of a work of this kind, together with a want of concert and agreement among the directors and engineers, are the principal causes of this increased expense.

"The single work called the Patterson viaduct has 10,000 perches of masonry in it. It is built of hewn granite blocks of from one to seven tons each. The height

from the water to the arches is 30 feet. It may, and in fact is, said to be 'truly a great work—an immense structure—creditable to the enterprise and public spirit of the company, and to the skill of the engineers.' All this, however, may with equal truth be said of the mausoleums, obelisks, and pyramids of Egypt. But after all, it has more of sound than substance in it.

"Directors and engineers of works of this kind ought to feel that every dollar expended for show and elegance is worse than lost; for it goes directly to retard or prevent the completion of their own enterprises, and to discourage all others of a similar kind.

"The interest of the money expended on this viaduct would probably be sufficient to erect a wooden bridge every year, which would last, almost without expense, ten or fifteen years.

"As the immense expense of the first thirteen miles of this road has had a great effect in damping the zeal and ardour in relation to similar enterprises in other parts of the Union, and particularly in this, I subjoin a few extracts from a recent report of the directors in relation to other parts of this road.

"The whole cost of masonry and gradation from Baltimore to Ellicott's mills was 46,496 dollars per mile.

"The next division, extending to the forks of the Petapsco, and now nearly completed, it is ascertained, will cost 10,022 dollars per mile.

"The third division, to Parr's Spring Ridge, will be but 7,001 dollars per mile.

"In fact, it has been satisfactorily ascertained, that the gradation and masonry of the first ten miles have cost more than the next fifty-six miles will cost.

"Great confidence is still felt by those most conmpetent to judge correctly in relation to this enterprise, that this road will yet be completed at an expense within the original estimate. Say 22,000 dollars per mile for a double track.

BOATING.

Sir,—With your permission, I would address a few words to the Young Boatbuilder, who makes an inquiry in No. 393, respecting the dangers to which small boats are liable. He is most undoubtedly right in supposing "that lowering the seats a few inches" would increase their stability; but, if he is really a boatbuilder, he ought to be aware that the seats of *small* boats are already so low, that there is no room for the alteration he suggests. By *small boats*, I understand him to mean skiffs, funnies, and wherries, such as are common with us on the Thames. By lowering and increasing the weight of the keel, and by adding generally to the depth and breadth of the boats, their stability will be proportionably increased; but, by so doing, their draught of water, and consequently the labour in working them, will also be proportionably increased. It is in attempting to obtain lightness of construction, that stability is, and ever will be endangered; in cutters, ships, boats, &c., which are of a larger description than those before mentioned, no such danger exists.—Yours, &c.

A Fireman-Waterman.

London, March 5, 1831.

NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

Improvements in the manufacture of Sugar, *M. Robinson, Westminster.*—1. The application of steam-heat to the evaporation of sugar *in vacuo.*—2. The use of a mixture of alum and lime, in the proportion of two pounds to 100 gallons, to purify the sugar; the acid being subsequently neutralized by the addition of three pounds of milk of lime.—*Date of Pat. Aug.* 5, 1830; *of Spec. Feb.* 5, 1831.

Supporting Block, *R. Clough, Liverpool.*—The block is to consist of four triangular pieces—the upper and lower twice the length of the end ones—and to be bound together by two iron hasps which turn on a hinge at bottom, and are secured by a screw at top.—*Date of Pat. Aug.* 5, 1830; *of Spec. Feb.* 5, 1831.

Improvements in Printing-machines, *Edward and Ebenezer Cowper, engineers.*—1. A new mode of distributing the ink, by means of a travelling elastic composition roller, connected with the type form, instead of the ink-table as heretofore. 2. The introduction of two small blanket-rollers, by means of which, as often as the blanketing of the paper cylinder becomes inked so as to set off, it may be at once removed, and clean blanketing substituted.—*Date of Pat. July* 19, 1830; *of Spec. Jan.* 19, 1831.

Improvements in Brewing and Dis-

TILLING, *A. Coffey, Dublin.*—1. In brewing, as regards the cooling of the wort; the apparatus employed consisting of two vessels joined together by a series of straight tubes, and of a revolving agitator in the lower of these chambers. 2. In distilling, as regards nearly the whole arrangements. The liquid passes from the wash-tub through some furlongs of pipe, more curiously than beneficially arranged; at one time ascending, at another descending, being now circular, now zigzagular, &c., it arrives at last at a series of evaporating shelves, down which it tumbles in succession; these shelves have a number of holes through which steam passes up from below for heating the wash; and as the alcohol rises, it is carried off by a large arched pipe into a receiver.—*Date of Pat. Aug.* 5, 1830; *of Spec. Feb.* 5, 1831.

IMPROVEMENT IN CARRIAGE-WHEELS, *J. Pearce, Tavistock.*—Consists in the application of naves made of wood, secured by strong hoops and plates of iron, to a wheel constructed in other respects like that of Mr. Theodore Jones, described in our 245th Number. *Date of Pat. Aug.* 5, 1830; *of Spec. Feb.* 5, 1831.

(*To be continued regularly.*)

Inquiries.

Sulphuric Acid.—I should be glad to be informed of the best method of obtaining *pure* concentrated sulphuric acid, of a specific gravity as compared to water of 1850 to 1000. As I want it for a purpose, where the smallest portion of nitric acid would be injurious, and defeat my object, I should imagine an acid made from sulphate of iron would be more likely to be free from such adulteration, and to answer my purpose.—Could such an acid be procured, and at what price per pound? A reply from any of your correspondents will much oblige —*A Constant Reader, February* 27.

Lead Pipes.—A constant reader of the Mechanics' Magazine is desirous of obtaining answers to the following queries, relative to the manufacture of lead pipes:—

1st. What power is requisite to draw a lead pipe of any given diameter and thickness, at a given *velocity?*

2d. In what proportion does the amount of resistance vary with the diameter of the pipe, assuming the thickness to remain constant?

3d. What is the utmost velocity which can be safely used in practice for drawing a medium-sized pipe, say of 2 inches bore?

Wheel-work.—I should be obliged to Mr. Harrison, or any other equally-well-qualified correspondent, to assist me out of the following difficulty. I have for some time been engaged in constructing a machine of my own invention, and, amongst other movements, I want a pair of wheels of such a size, that one shall make 90 revolutions in the same time that the one it works into makes 150 revolutions. My centres are fixed, and are two inches and one-tenth distant from each other, and cannot be altered; other circumstances, too, oblige me to make the pitch twenty-two hundredths of an inch. The proper diameters of these wheels I have not yet been able to find."—*S. J. Dryden.*

Cements.—I am at a loss for some kind of composition for joining the jambs and slips together of chimney-pieces; plaster of Paris will not adhere to slate (Carnarvonshire at least); as it hardens, the slate perspires, and the plaster loses hold. Perhaps some of your correspondents can inform me of a substitute for plaster, or some kind of wash, which, applied to the stone, would cause the requisite adhesion.—*W. J—s, March* 3.

Dissolving India rubber.—Is there any cheaper method of making a varnish with India-rubber, for rendering brown-holland air-tight, than that of dissolving it in spirits of turpentine?—*A Constant Reader.*

NEW MATHEMATICAL PROBLEMS.

1. *By S. E. Erickson, pupil, Mansion-house School, Hammersmith.*

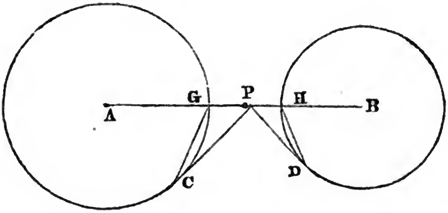
A banker discounts bills at equal intervals, so as to have four returns of his money in the year. B improves an equal sum at compound interest, payable quarterly. Suppose both to have the same interest for their money, how much richer will the banker be than B, at the end of 20 years. And give an example in numbers, when the first principal of each is 10,000*l.* $n = 20$, and the rate per cent. per annum 5.

2. *By an Oxford Student.*

Suppose $\cos. A. \sin. B + \sin. B = \sin. A. \cos. B.$ Determine the relation of the arcs A and B.

3. *By Mr. Thomas Hogan, Mathematical Tutor.*

Given two circles A and B :—



Required to find a point P in the line joining their centre, from which two tangents PC, PD, be drawn, and draw the chords CG, DH, so that CG : DH in any given ratio, as *m* to *n*.

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4. *By an Edinburgh Student.*

If from any point in the circumference of a given sector of a circle, perpendiculars be drawn to the two radii; the straight line which joins the extremities of the perpendiculars will be a constant quantity. Demonstration required.

P.S. The above theorem is new, as far as I know; but whether it is so or not, I find that several important trigonometrical formulæ may be deduced from it in a simpler way than by any other method I have ever seen.

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5. *By* Δ.

Required to find the curve in which the difference of the subtangent and abscissa is to the abscissa, as the tangent is to the ordinate.

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6. *By G. S.*

Determine a triangle, the three sides of which shall be whole numbers. Also the perpendicular, let fall from the vertical angle upon the base, so that the segments of the base may be all whole numbers; and lastly, the perimeter of the triangle a minimum.

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7. *By Nemo.*

Find the value of x, when $\frac{x^3}{x-1}$ is a minimum, and prove that it does not admit of a maximum.

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8. *By Kinclaven.*

To divide a given circular arch into two parts, so that the excess of the chord of the one above the chord of the other may be equal to a given straight line, less than the chord of the whole arch.

P. S. The above problem is the 48 proposition of the supplement to the 3rd book of Euclid, by D. Cresswell, M.A., Fellow of Trinity College, Cambridge. He has given a most bungling solution of it. I have no doubt but some of your ingenious contributors will give the best solution it is capable of.

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9. *By Mr. J. Gilbert, Jun.*

An uniform bar, 10 feet long and 4 inches square, has a weight hanging at one end, and when the whole is in equilibrio, the fulcrum is distant one foot from the middle of the bar. That half of the bar, at the end of which the weight hangs, is composed of two uniform pieces, each 5 feet long, and 2 by 4 inches section; now, if one of these pieces be taken out, what must be the place of the fulcrum, when the whole is at rest?

LIST OF NEW PATENTS GRANTED FROM 21ST OF FEBRUARY TO 21ST OF MARCH, 1831.

Jeremiah Grime, the younger, of Bury, county of Lancaster, copper-plate engraver, for a method of dissolving snow and ice on the trams or railways, in order that locomotive steam-engines and carriages, and other carriages, may pass over rail-roads without any obstruction or impediment from such snow or ice. Six months, to specify from 21st February, 1831.

Richard Burgess, of Northwich, M.D., for a drink for the cure, prevention, or relief of gout, gravel, and other diseases, which may be applied to other purposes. Two months, 21st February, 1831.

Samuel Dunn, of Southampton, engineer, for certain improvements in generating steam. Six months, 21st February, 1831.

Richard Thevithick, of St. Aith, for an improved steam-engine. Six months, 21st February, 1831.

Richard Thevithick, of Saint Aith, Cornwall, for a method or apparatus for heating apartments. Six months, 21st February, 1831.

William Sneath, of Ison Green, Nottingham, lace-maker, for certain improvements in, or additions to, machinery for making, figuring, or ornamenting lace, net, and such other articles, to which the said machinery may be applicable. Six months, 21st February, 1831.

Richard Abbey, of Walthamstow, gent., for a new mode of preparing the leaf of a British plant, for producing a healthy beverage by infusion. Six months, 21st February, 1831.

William Furnival, of Wharton, Esq., for certain improvements in evaporating brine. Six months, 21st February, 1831.

John Phillips, of Arnold, county of Nottingham, servant-man, for certain improvements on bridles.—Six months, 21st February, 1831.

David Seldon, of Liverpool, merchant, for an improvement or improvements in machinery, used to give a degree of consistency to, and to wind on to bobbins, barrels, or spools, rovings of cottons, and the like fibrous substances, communicated to him by a foreigner residing abroad. Six months, 26th Feb. 1831.

Richard Williams, of College-wharf, Lambeth, engineer, for certain improvements in steam-engines. Six months, 28th Feb. 1831.

David Napier, of Warren-street, Fitzroy-square, engineer, and James Napier, and William Napier, for certain improvements in machinery, for propelling locomotive carriages. Six months, 4th March, 1831.

Apsley Pellatt, of Falcon Glass Works, for an improved mode of forming glass vessels and utensils with ornamental figured patterns impressed thereon; partly communicated by a person residing abroad, and partly discovered by himself. Six months, 9th March, 1831.

Robert Stephenson, of Newcastle-upon-Tyne, engineer, for an improvement in the axles and parts which form the bearings at the centre of wheels for carriages which are to travel upon edge-railways. Four months, 11th March, 1831.

Charles Wood, of Macclesfield, manufacturer, for certain improvements in machinery for spinning cotton, silk, flax, wool, and other fibrous substances of the like nature, as well as for throwing, doubling, and twisting threads and yarns made of the same materials. Six months, 11th March, 1831.

William Peeke, of Torquay, shipwright, and Thomas Hammick, of the same place, shipsmith, for certain improvements in rudder-hangings and rudders for ships or vessels. Six months, 21st March, 1831.

George William Turner, of Bermondsey, paper-maker, for certain improvements in machinery or apparatus for making paper. Six months, 21st March, 1831.

Peregrine Phillips, jun. of Bristol, vinegar-maker, for certain improvements in manufacturing sulphuric acid, commonly called oil of vitriol. Six months, 21st March, 1831.

John Potter and James Potter, of Spiedly, near Manchester, spinners and manufacturers, for certain improvements in machinery or apparatus applicable to the spinning or twisting of cotton, flax, silk, wool, and other fibrous materials. Six months, 21st March, 1831.

George Royl, of Walsall, in the county of Stafford, whitesmith, for an improved method of making iron pipes, tubes, or cylinders. Six months, 21st March, 1831.

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NATIONAL REPOSITORY, for the Annual Exhibition of New and Improved Productions of the Manufacturers of the United Kingdom, in the Gallery of the Royal Mews, Charing-cross.

Patron—The KING.

Artists, Manufacturers, Patentees, Modellers, Mechanical Draughtsmen, &c. &c., are requested to notice that the arrangements now in progress for the immediate opening of the Fourth Annual Exhibition to the Public, renders it highly important that the Specimens intended for Exhibition this present Season should be sent to the Repository without delay.

In consequence of the grant made by his Majesty's Government of the use of this Public Building for the purpose of promoting and encouraging New Inventions and Improvements in the Arts, Sciences, and Manufactures of this country, no fees or charges of any kind are made for the Exhibition of any New Invention or Improved Production in the National Repository.

By order, T. S. TULL, Secretary.

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INTERIM NOTICES.

An appendix to Vol. XIV. will be published next Saturday, containing solutions of most of the mathematical and other questions which have appeared in the course of the volume, and have not yet been answered.

The Supplement to Vol. XIV. containing the Titles, Preface, and Index, will not be ready for delivery to town subscribers till the 9th of April. It will be embellished with a large copper-plate engraving of autographical memorials of all the more eminent men of science, engineers, and mechanics, of the nineteenth century.

F. H. of Birmingham seems to us to have deceived himself. He takes it for granted that the line DE passes through H, and that of GIK through I. Let him try and prove this, and he will probably find out his error.

A Supplementary Reply of seven closely-written pages of foolscap, from the Ed. Vocis Rationis to Mr. Baddeley! Really this is unconscionable. All that is material in it may be given in a couple of pages; and to this it must be reduced, if the author continues desirous of its insertion.

Communications received from S. B.—Hezron—A Working Mechanic—Mr. Baddeley—W. M. G.—Y. S.

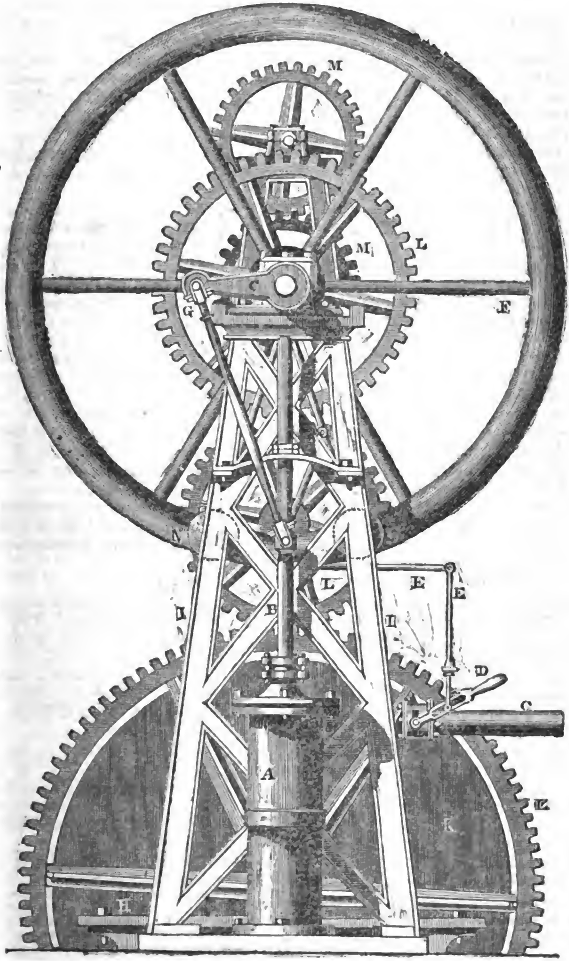
LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 399.] SATURDAY, APRIL 2, 1831. [Price 3*d.*

MESSRS. CHRISTIE'S HIGH-PRESSURE STEAM-ENGINE.



HIGH-PRESSURE STEAM-ENGINE, CONSTRUCTED BY MESSRS. CHRISTIE, OF SHEFFIELD.

(*Continuation of a series of communications furnished on the steam-engine in vol. 7, Mech. Mag. By Mr. Christopher Davy.*)

The information to be derived from an attentive observation of the various methods devised for expediting and improving the manufactures of the country, is beyond all calculation; especially when promoted by a frank and social interchange of ideas between workmen, relating to the practical difficulties they have individually experienced. We are aware that, even in the present day, such liberality is far from being common, and that a jealousy of inquiry is a prevailing characteristic of the operative classes; but it is to be hoped that ere long they will appreciate more justly the benefits of publicity, and be satisfied that it is only by the openest competition that they can sustain and perpetuate their pre-eminence over the artizans of other nations. "Wren," says Allan Cunningham, "sought for his information not in ingenious theories, but in every-day practice—not among the dreamers of the Royal Society, but by conversing with skilful masons, carpenters, and blacksmiths." The Wrens of the present day (if there are any) might pursue the same course with still greater advantage, inasmuch as the working classes are now much better informed than they were a century or two ago. They now possess the means of obtaining an education, at once practical and scientific, at a cheap rate, and not a few have availed themselves of its benefits. The English manufactories are in themselves museums of ingenuity worthy of a careful and attentive examination; and none are more so than those whose business is the construction of machines. The nicety of workmanship and harmony of arrangement exhibited in many of these machines do equal credit to the workman who constructs, and the engineer who designs them, and have hitherto set foreign competition at defiance.

As the steam-engine exhibits in its details almost every possible variety of motion, I shall occupy a few communications (given from time to time) in describing its different modifications. The proportions of engines have been already treated upon in the pages of the Mechanics' Magazine; aided by an invaluable table, leaving scarcely any thing further to be desired under that head. The principal modifications of the steam-engine may be classed under the following heads. 1st. Engines with perpendicular cylinders, piston working in slides without the cross head. 2nd. Those with a cross head and slides. 3rd. Perpendicular cylinders, parallel motion, and beam. 4th. The rocking cylinder. 5th. The horizontal cylinder. 6th. The slanting cylinder. 7th. The rotary motion. 8th. Double horizontal cylinders. 9th. Double vertical cylinders. And 10th. The boat engine.

The first example that I have chosen, is an engine on the high-pressure principle, the construction of Messrs. Christie, of Sheffield, engineers.* It is employed at Burdekin's Anvil Manufactory, Sheffield, for the purpose of turning a large grindstone and working three pairs of bellows. The grindstone serves to grind the faces of anvils, some of them weighing 800lbs.; it is, notwithstanding, calculated at only 2-horse power, having a 7-inch cylinder. Mr. Hebert observes, that "the engine is worked 66 hours each week, consumes 1200 gallons of water in that time, and about one ton of small coal or culm—value on the spot *5s. 4d.*" The pressure on the safety valve is 30lbs. per square inch.; the boiler is cylindrical, wrought of the best Yorkshire iron, and $\frac{3}{8}$ths thick.

The extreme simplicity of this engine, and the little room that it occupies, are very deserving attention. The parallel motion for the piston-rod is also simple and effective. An examination of the drawing (a front elevation), assisted by the following references, will show the relative situation of the different parts.

A, the steam cylinder.

B, the piston-rod, working through the bridge on the frame.

C, Steam-pipe, connected to the valve-box at the back of the cylinder, the valves being worked by an eccentric on the fly-wheel shaft.

D, E, E, throttle valve; rods or levers attached to the governor, N.

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* For the original drawing of this engine I am indebted to Mr. L. Hebert, C.E. and Editor of the Register of Arts. I have, however, made an addition to it by introducing the whole of the toothed geering.—C. D.

F, fly-wheel.

G, G, crank, connecting-rod, jib, &c.

H, iron frame for the large-toothed gear and the grindstone.

I, I, cast-iron main frame for the engine.

K, the grindstone.

L, L, L, toothed gear, communicating motion to the stone.

M, M, bellows gear.

N, the governor.

The supply-pump for the boiler is situated in the space between the steam cylinder and the grindstone; it is worked by an eccentric. I should observe, that although in the drawing I have (for the sake of better appearance) placed the toothed wheels with their axis perpendicular to each other; in practice they would have an inclination; for in their present situation the consequent wear and tear would cause them to press downwards; and materially retard the engine by an increase of load. C. D.

CHEMICAL DISCOVERIES OF SIR HUMPHREY DAVY.

(Concluded from our last.)

In the year 1812, at the age of 32, Davy stood on one of the proudest heights of science. By his extraordinary discoveries he had extended the empire of man over matter; by strong powers of reasoning, united with great ingenuity of research, he had changed the features of chemical science; he had brought over to his own views nearly the whole chemical world; he had secured the homage of many scientific bodies in different countries, and commanded universal admiration. If we look over the Philosophical Transactions, and Scientific Journals from 1798 to 1812, the rapidity with which we find his great achievements to have followed each other reminds us of nothing less than the victories of Alexander; which, it will be recollected, were gained within the same short period, and at nearly the same time of life. Neither did the Macedonian distinguish his youth by more extraordinary conquests over man, than our philosopher signalized his by conquest over matter. Nor can we forbear to pursue the comparison, and remark, how transient were the monuments which the hero erected for himself; for how short a space he broke the stream of time which soon closed up again, and flowed on as before, while the achievements of the philosopher, developing as they do, the immutable laws of nature, are alike imperishable, and bear in themselves the elements of immortality.

Released now from the arduous duties of Professor of Chemistry at the Royal Institution, and having become the possessor ot once of an amiable lady and a large fortune, he seems to have seated himself to take an account of his stock of science, and to digest plans for a life of learned leisure. His "Elements of Chemical Philosophy" shortly appeared as the first fruits of this retirement, purporting to be, as was supposed*, the first of a series of volumes to embrace the entire philosophy of the science. Although it advances no further in the system, than to expound the "Laws of Chemical Changes," and to give the history of "Undecompounded Bodies," which is all included in a small volume of less than three hundred pages, yet it comprehends so much of chemical science, that Dr. Ure acknowledges that much of the purely chemical part of his dictionary is derived from this work alone.†

But among the privileges conferred by a learned leisure, and an easy fortune, few could have been so gratifying to Sir Humphrey as the opportunity for *foreign travel.* A nation is interested in the travels of such a citizen. The whole world is to him an El Dorado; from every land and sea he gathers gold and pearls; and returns deeply freighted with the intellectual riches of other climes, to pour them into the lap of his country. The Philosophical Transactions bear ample testimony how justly this remark applies to Sir Humphrey Davy.

The beautiful *remains of ancient painting* at Rome and Pompeii, suggested the means of ascertaining, by actual analysis, the nature of those pigments which have retained their freshness and brilliancy through so many centuries. By such means, the artist is taught how to prepare for himself the azure of Egypt and the purple of Tyre.

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* Such was the expectation of Dr. Thomson, (Annals of Phil. I. 372,) who supposes the entire work cannot consist of less than five or six volumes. We are not informed of the reason why the author did not proceed with the work.

† Ure's Dict. Chem. *Introduction*.

The *manuscripts found in the ruins of Herculaneum*, originally 1696 in number*, excited the hopes of the scholar, that could some method be devised for unrolling them, we should find many of those works of the ancients, (as the deficient parts of Aristocle or of Livy) the loss of which is so deeply deplored. Sir Humphrey had made a few experiments on certain fragments of papyri while in England, in 1818, which encouraged the belief that chemical agents might be found, which could be so applied to the manuscripts, as to separate their folds without destroying their texture. The Prince Regent, Lord Liverpool, and Lord Castlereagh, afforded ample means for defraying the expenses of such an undertaking; and the experiments were prosecuted for two months upon the MSS. belonging to the Museum at Naples. During this period, he succeeded in partially unrolling twenty-three MSS., and he examined about one hundred and twenty more which afforded no hopes of success. In addition to the labour, in itself difficult and unpleasant, he had to encounter unexpected obstacles thrown in his way, by the jealous superintendants of the Museum; and he was therefore induced to abandon the undertaking before he had fulfilled the anticipations he had inspired. The enterprize, however, does not appear to have been entirely abortive. Its results threw some light upon the character of this collection of manuscripts, and upon the modes of writing employed by the ancients.

The *volcano of Vesuvius* presented an object to his curiosity unembarrassed by any impediments of human jealousy. It was the more interesting to our philosophic observer, because it afforded peculiar faculties for comparing its phenomena with a conjecture he had thrown out in a paper on the decomposition of the earths, published in the Philosophical Transactions in 1812, *that the metals of the alkalies and earths might exist in the interior of the globe; and on being exposed to the action of air and water, give rise to volcanic fires.* The facts, as observed at Vesuvius, appeared to strengthen this supposition, and the opinion is evidently gaining ground among geologists.

In a passage on the Danube, the attention of Sir Humphrey was attracted towards the *morning fogs* that hang over rivers, and he was led to investigate the circumstances, and to propose an explanation, which is generally received in meteorology as the true theory of Mists.* His explanation, however, we cannot but consider as erroneous. The true cause we believe to be this: a fog is formed whenever watery vapour rising from the earth meets with colder air, which condenses it. Now, a large river, like the Danube, does not become sensibly colder during the night than it was the preceding day, but continues to send off vapour nearly in the same quantity. But the air over the land becomes a number of degrees colder at night than by day and the vapour coming into contact with; the colder air, is condensed into fog. Sir Humphrey supposes the fog to be produced as follows: the air over the river, by the influence of the stream, remains warmer than the air over the land on each side; and the colder and the warmer portions of air being mixed, the fog is precipitated from the latter. But this phenomenon takes place over rivulets, the breadth of which is so small that we cannot suppose the temperature of the incumbent air to be at any moment essentially different from that of the banks.

The year 1815 was rendered memorable by the invention of the SAFETY LAMP. The process by which he advanced to the discovery was so curious and instructive, that we are induced to follow it step by step. First, he ascertained, by full and exact inquiries, all the facts of the case as known to the miners. Secondly, he proceeded to learn more fully the properties of the agent which he was to attempt to control. *What is this fire-damp?* He analyzed it and found it to be, as other chemists had said, a variety of carburetted hydrogen gas. *What will kindle it?* A red-hot iron will not—a burning coal will not. It therefore requires a higher degree of heat to inflame it than most other explosive gaseous mixtures. And here an important inference met him, *that if the gas, when on fire, were cooled, it would be extinguished.* Again, carburetted hydrogen, by burning, produces *carbonic acid*, and the atmospheric air with which it is mixed in the explosive compound produces *nitrogen;* and each of these products, added to the explosive mixture, greatly impairs, or even destroys its power of exploding; and therefore, since these rise from a burning lamp, they would of themselves prevent the communication of the flame through the open chimney of the lamp. *Under what circumstances does the fire-damp burn with explosion?* The general reply is, when mixed with air; but experiments were instituted to ascertain the effect of different proportions of air. One part of fire damp, and any portion of air less than four parts, burnt without explosion. Seven or eight of air to one of the other, constituted the most highly explosive mixture. In fifteen of air to one of fire-damp, a lamp burnt without explosion, and with the flame greatly enlarged. *Through what channels (if there be any) between two separate portions of these explosive mixtures, will the flame, when applied to one of them, refuse to pass the other?* Will it pass through a tube. This brought him to the grand discovery; for it appeared, that the flame of the most explosive mixture would not pass through a small tube,—that the communication was more easily prevented, in proportion as the tube was of a better conducting substance, and therefore operated by *cooling* the flame below the point of kindling. It was only then to surround a lamp with a transparent envelope communicating with the surrounding air by metallic tubes, and thus the air might enter freely to feed the lamp, while the flame would not be communicated to the surrounding atmosphere, in the most explosive state in which it ever could exist in a coal mine. Subsequent experiments proved, that in case the diameters of the tubes were very small, their lengths might be diminished to mere apertures; and hence it was only necessary to surround the lamp with wire gauze, and the air would enter freely to supply the lamp, while the flame could not pass through the apertures of the gauze.

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* Phil. Trans, 1821.

* Phil. Trans. 1819, p. 126.

We are not aware of any other example of a great invention so purely philosophical as this. Most inventions have been partly at least the suggestion of accident. But here our philosopher *commenced*, not with constructing a lamp, but with inquiring into the *nature and properties* of the agent which he had to controul. He *began*, like the Philistines of old, by learning where lay the secret of its might: this being discovered, it was shorn of its strength as easily as the giant of Israel. But he did more than simply disarm the foe: he made him his slave. In the most explosive mixtures, the flame of the lamp is greatly enlarged, and its light much augmented; and by this change, it gives to the miner instant warning of the approach of danger.

After the year 1812, Sir Humphrey does not appear to have to have exercised the vocation of a chemist professionally; but his attention was immediately recalled to the subject, whenever any new discovery of importance was announced. Thus in 1813, soon after the discovery of *Iodine*, he happened to be at Paris, "receiving (says Dr. Ure) amid the political convulsions of France, the tranquil homage due to his genius." Two able chemists, Messrs. Clement and Desormes, had investigated some of the properties of this singular substance, but had come to no decisive conclusions respecting its nature. Dr. Ure informs us,* that the English philosopher penetrated at once, with intuitive sagacity, the mystery which hung over it, while he and M. Gay-Lussac set out about the same time, and with equal ardour, to investigate its relations to other bodies, that is, to ascertain its nature. In finding its relations to such chemical agents as oxygen, hydrogen, and potassium, it soon became evident, that it was a body of the same class with oxygen and chlorine; and so much strength was thus acquired by Davy's views respect- the nature of chlorine, that, as we have already remarked, scarcely a chemist of the age any longer hesitated to embrace them.

In 1820, the discoveries of Mr. Oersted, of Copenhagen, respecting *the connexion between magnetism and electricity*, opened another new field for original research, and Sir Humphrey appeared again among the foremost to explore it.† Thus, while he seemed to have retired from the profession of a chemist, yet in every thing that appertained to the enlargement of the science, he resumed his labours so effectually, that his authority was still quoted oftener than that of almost any other man.

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* Dictionary of Chemistry, Art. Iodine.

† Phil. Trans. 1821, pp. 7 and 425.

The last great scientific effort of Davy, was *his discovery of a method of protecting the copper sheathing of ships from corrosion by sea-water.* The history of this undertaking, as well as its mode of accomplishment, bears a strong analogy to that of the safety lamp. He entered upon it at the request of the Navy Board of Great Britain, and prosecuted it by steps indicated solely by philosophical principles. The method of proceeding in this and all similar cases, seems indeed to be sufficiently simple and obvious—namely, first to ascertain the cause of the evil, and then to find out how to controul it by studying its nature. But obvious as this method of making great discoveries is, yet it has rarely been followed; but most discoveries, in their first stages at least, have either been stumbled on by accident, or been the fruit of experiments, that were more or less empirical. The principles that guided Sir Humphrey, on the present occasion, were suggested by a theory proposed and expounded by him in the Bakerian Lecture for 1806, of which the leading points were as follows:—That chemical and electrical attractions are identical, or at least dependant on the same cause; that, consequently, substances will combine only when they are in different electrical states; and that, by bringing a body naturally positive into a negative state, its usual powers of combination are altogether destroyed.* He informs us, that he was conducted by these principles to the discovery of the metallic bases of the alkalies. For if potash, for example, were a compound, and its constituents were held together in consequence of their being in opposite electrical states, then, according to known laws of electrical attraction and repulsion, it was only to apply to them electrical powers of greater intensity, and they would be separated from each other,—the negative constituent would leave the positive for a body positive in a higher degree; and the positive constituent would leave the negative for a body negative in a higher degree. Now, the voltaic apparatus, which admits of indefinite extension,) affords the means of producing the opposite electricities, at the two poles, of a degree of intensity exceeding that which exists between the constituents of any given compound; and thus all the combinations of matter are brought under its dominion. Although this hypothesis was adopted by Berzelius, certainly one of the most competent judges in the world, yet it had not been generally received by chemists. Its author, however, had some reason to feel attached to an hypothesis, which had conducted him to so successful a result in his galvanic researches, and he resolved once more to follow its suggestions. He reasoned thus:—The cause of the corrosion of the copper sheathing of ships is a chemical action of sea-water upon copper, and this is owing to their being in opposite electrical states, the copper positive and the water negative. How shall this action be destroyed? By rendering the copper negative; for then the metal and the water being in the same electrical state, no affinity can exist between them. Now tin, and zinc, and iron, being respectively positive in a much higher degree than copper, have each the power, when joined to copper, of rendering it negative. Indeed it was ascertained by trial, that so great was the power of these oxidable metals over copper, that a piece of tin soldered to a sheet of copper, would protect a surface one hundred and fifty times as large as itself *perfectly*, and would *partially* protect a surface one thousand times as large as its own. After various trials, cast iron was found to be, on all accounts, the most eligible substance for protecting copper from the action of sea-water. All the facilities for trying these experiments on a large scale were afforded him by the government, at the magnificent naval establishments at Chatham and Portsmouth; and the results promised to provide a complete remedy for the evil under which the navy and commerce of Great Britain had suffered so severely. But a consequence which ought to follow in accordance with the hypothesis, and which the author had anticipated, (though not to the extent it occurred,) has limited, if not entirely subverted the practical utility of the discovery. The copper sheathing, rendered artificially negative, acquires the power of attracting all those ingredients of sea-water, which are naturally positive, as lime and magnesia. These form a crust on the surface of the copper to which sea-weeds and shell fish adhere, which in long voyages create an impediment, that is paramount to the advantages derived from the protection of the copper from corrosion. Although an nexpected consequence has limited, or at least for the present embarrassed, the practical applications of this discovery, yet the object sought for, namely, *to protect copper sheathing from corrosion by sea-water*, was fairly and fully attained; and the philosophical process which conducted to the discovery, was complete and perfect, like that which led to the invention of the safety lamp.

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* Phil. Trans. 1824, p. 153.

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A FEW REASONABLE CONSIDERATIONS ADDRESSED TO THE AUTHOR OF THE "VOICE OF REASON."

Sir,—I have considered with attention the plan for a "perpetual motion," invented by your correspondent, the "Author of the Voice of Reason," and however ingenious the author, I cannot but express my conviction, that, in the formation of this theory, he is labouring under a very considerable mistake. In his first communication he tells your readers that he constructed a model of his invention, which I do not doubt; but I beg leave to ask him this plain question, whether his model would work after it was made, and how long its motion continued? For I imagine the contrivance to be as remote from perpetuity of motion, as the beam of a pair of scales.

In the plan laid down by your correspondent, it requires one entire revolution of the water wheel to produce a single stroke of the piston, and by the same rule, the water expressed by one operation of the piston, must furnish the impulse for an entire revolution of the wheel. The pistonic operations might indeed be multiplied by the introduction of a pinion revolving to the water wheel in the proportion of 2 or 3 to 1; but just in proportion to the number of revolutions made by the pinion, there must be an increased expenditure of momentum on the water wheel, it being an invariable law in mechanics, that what is gained in time, is lost in power; therefore, there would be nothing in reality either gained or lost by this manœuvre.

We will suppose the barrel of the pump to be six inches in diameter, and that every stroke of the piston will produce a cylindrical column of water, two feet in length. I put it to the good sense of your correspondent, whether it be possible to employ this inconsiderable force in such a manner, as to cause a wheel of such magnitude to revolve with all its appurtenances, and a weight of water attached to it sixteen times heavier than the impulse?

If it be answered that a constant stream will be accomplished by the small aperture at the bottom of the cistern, I reply this does not meet the objection; for a constant supply is only a succession of parts which do not push each other; and whether a portion of the water be suffered to gush out of an aperture at the bottom, or the whole be allowed to fall over the tumbling bay at the top of the cistern, no real advantage will be obtained; for no more than a two-feet column of water can be brought into action till the wheel has completed its revolution.

The wheel and crank being a lever of the first class, in order to balance a weight equal to 32 (the column of water in the pump), by a pressure equal to 2 (the water drawn by a stroke of the piston), the arms of the lever must be in the proportion of 16 to 1; now to accomplish a two-foot plunge into the barrel of the pump, the crank, or short arm of the lever, must be one foot from the fulcrum, or axis of the wheel, consequently the radius of the wheel must be 16 feet, giving the whole diameter 32 feet (exactly the height of the pump); and then what becomes of the intermediate machinery of the three water wheels, &c.?

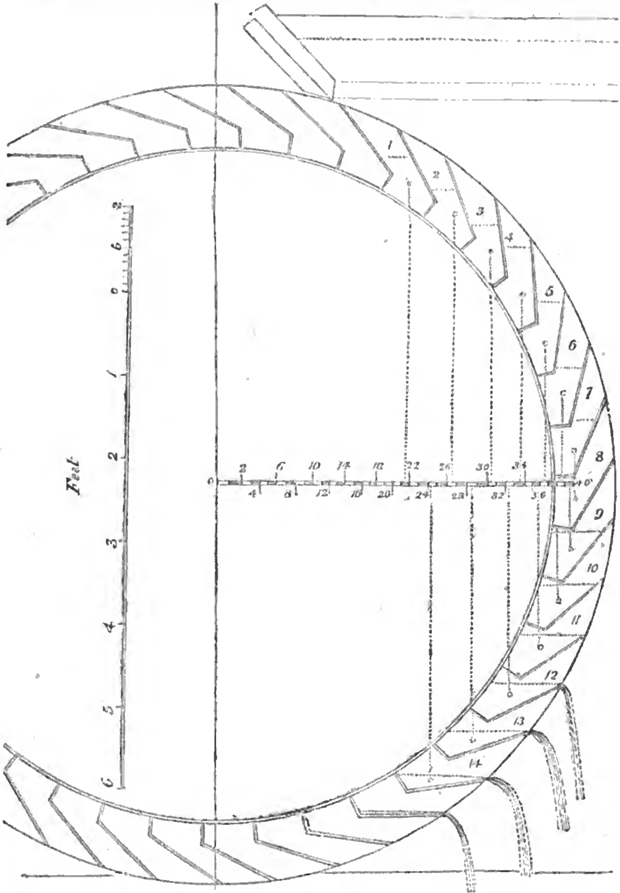
If the radius of the wheel be increased, it must be raised higher; and I ask again, how can so feeble an impulse be employed to give an entire revolution to such a ponderous body resting on its axle?

Your correspondent asks, of what use are all the "perpetual-motion" machines? &c. I might answer this question by asking another: Where will he find one? Every attempt of the kind hitherto submitted to the public has been an entire failure, founded on a false theory. No such thing as a self-moving machine ever *has* been invented; and whether it ever *will*, remains a subject for the inquisition of the curious.

Yours, &c.

A. Crookenden.

DEMONSTRATION OF THE IMPOSSIBILITY OF A PERPETUAL WATER-WHEEL.



" From this example you may see how desirous people are to reach their object in their own way—what need there often is of enforcing on them truths which are self-evident—and how difficult it may be to reduce the man, who aims at effecting something, to admit the primary conditions under which alone enterprise is possible."—GOETHE.

Sir,—At the suggestion of Franklin, (No. 390), but still more with a hope of freeing the pages of the Mechanics' Magazine in future from such absurdities as those of Vocis Rationis (No. 389, &c.), I am induced to make an attempt to demonstrate the utter impossibility, under any circumstances, of making a water-wheel that will supply itself instead of having any surplus power.

The accompanying drawing represents part of an overshot wheel in section, the buckets only part filled, by which the whole of the water expended continues to act through a greater portion of the circumference, than it otherwise would do; the area of the vertical section of the complement of water to each bucket is made 40 inches; and taking the breadth of the wheel at, say 28¼ inches, gives 40lbs. as the weight of water in each bucket; therefore, as there are 12 buckets containing 40lbs. each, No. 13, 30lbs., and No. 14, only 20lbs. altogether making a total of 530lbs. acting on the wheel at the same time. To show clearly all the effect that can be expected, from this I have divided the horizontal radius into a scale of 40 equal parts (there being 40lbs. in each bucket), and from the gravitating centre of the fluid contained in each, is drawn a perpendicular to the scale, where the effective force, or weight in each bucket, may be read off as on the arm of the common steel-yard. The weights will be found as follows, viz.:

No.	lbs.	No.	lbs.
1	21½	8	40
2	26¼	9	39½
3	30½	10	38
4	33¾	11	35¾
5	36¼	12	32½
6	38¾	13	21 }*
7	39¾	14	12 }

It is therefore quite evident, that although we have 530lbs. acting on one side of the wheel, a column of water weighing 446lbs. re-acting at the same distance from the centre, on the opposite side, will exactly balance the whole 530lbs. contained in the buckets; so that about a sixth of the expenditure rests on the axis, without producing any useful effect, and the wheel so loaded must remain in a state of rest. Now, in spite of friction, and the vis inertia of matter, if we suppose the wheel at work, it can raise only 446lbs. at the expense of 530lbs.; but even if it could raise the whole 530lbs., we should then be but little nearer the mark, for we must remember, that the gravitating centre of our power falls through a space of only 8ft. 11in., while the water must be raised at least 11ft. before it could be laid on, and delivered clear of the wheel.

As a further means of coming at the end, I had in view, at the commencement of this letter, I will conclude with a simple rule, for calculating the quantity of water a wheel of this kind will raise:—Multiply the number of pounds expended in a minute by the height or diameter of the wheel in feet, divide the product by the height (also in feet) of the reservoir to be filled, and two thirds of the quotient will be the answer required. *Example*, for the wheel above described, making 6 revolutions per minute.

42 buckets on wheel.
6 revolutions per minute.

252 buckets filled per minute.
40 the weight of water in each bucket.

10080 lbs. expended per minute.
10 feet height of wheel.

11) 100800 momentum, dividing by 11 feet as the height of reservoir.

3) 9163·636 dividing by 3.

3054·545 multiplying by 2.
2

6109·09 answer in lbs.

So that for every 1008 gallons expended on the wheel we only gain sufficient power to supply, 611 nearly. Yours, &c. Trebor Valentine.

Derby, March 4th, 1831.

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* Two thirds of the value of No. 13, and only half that of No. 14 are here taken, as the contents are respectively 30 and 20lbs.

THE THEORY OF LOCOMOTION.

Fig. 1.

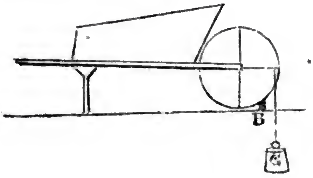
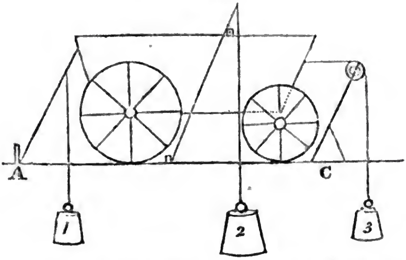


Fig. 2.



Sir,—In reply to your correspondent, "Telum," No. 395, page 11, I have only to ask some more time for the promised elucidation of my new theory of locomotion, and it shall be forthcoming; I wish some one else to explain the true theory of the "famous wheelbarrow problem," before I send it. I seek to gain information as well to give, and as Telum says he knows but little of mechanics, I must make my bow to him, and pass on to B. C., No. 396, page 28; to whom I owe an apology for taking off his head with so little ceremony; long may it remain to grace his shoulders and the pages of your work; I would not hurtfully discompose a hair of it. I detest tyranny and despotism in every shape; I only meant to cut him short with a brief answer, because I thought he was giving too hasty an opinion upon a subject of importance, which has probably occupied more nights and days of mine, than hours of his; and though I regret the manner of my reply, I maintain the matter of it. Locomotion, as a science, he is yet unacquainted with; his solution of the wheelbarrow problem, in No. 385, is too indefinite to be correct.

I, too, hate mere controversy; so B. C. and myself shall, I doubt not, be on very good terms. I am glad he has fairly entered the ring, and come to the scratch; I hope he will allow me good humouredly to say, that I will soon floor him, as I must try do-all opponents, or my boasted theory will break down. It must be Saxula against all comers, with you, Mr. Editor, for judge,—his fall will do him no harm,

> "For e'en when vanquish'd, he can argue still."

His present strictures will do my theory none. To reply in detail:—

1st.—I have not as yet given the theory of the wheelbarrow problem; I only gave the practice, No. 385, page 299; therefore I cannot have confounded "power and resistance," at present. His second explanation of the process, in page 29, is also incorrect; because, if I apply only the force of my own gravity on the spokes of the wheel, as in fig. 1, where the weight G represents the force of gravity, the wheel will turn round without advancing the barrow over the bar B, it will be a mere tread-mill operation, not locomotion; my gravity should be on the axle of my muscular action, with perhaps a little (though not necessary), gravity on the rim of the wheel. Let B. C. not think it "needless to give himself the trouble," but let him prove it, various ways, and be convinced that he is mistaken, even in the onset. Let him try to pass the barrow over an inch bar his own way, by mere gravity, and fail,—"that's all." This curious problem, when a maximum, can only be solved by the nicest arrangement of gravity and muscular action; but more in explanation of it I shall not at present say, except that the simple theoretical secret is not yet disclosed either by Mr. Clive, Saxula, or any one else. I hope he will not dispute about mere verbalisms, when the meaning is apparent. I and barrow certainly trundled, or moved up the hill and over the bar together, the barrow only touching the ground; and any of your readers may do the same; I have not "imposed upon myself" as regards the fact. Can he call that barrow empty that has a man's weight resting on the two "side bars?" This takes it out of the rule of Paddy's sedan, for Pat's ten toes were in the mud. 3rd.—He is mistaken as to my thoughts and "considerations" altogether; I did not deduce the theory from the wheelbarrow operation, but the operation from the theory, as before stated in page 349, No. 388, I should previously have thought it impossible. 4th.—I can assure him that the case of a boat, page 30, is not similar to that of locomotive machines propelled by power applied to turn the wheels; it may be to those moved by propellors or legs; the difference is great, very great. He assumes, on this head, for the foundation of his adverse investigation, that the fulcrum of an oar in rowing a boat is not in the water; he says "the fulcrum is, in this instance, at the edge of the boat, and *not in the water*." What say the treatises on mechanics? I quote from one now before me—"The oars and rudders of vessels are levers of the second kind; the vessel is the weight or resistance, *the water is the fulcrum*, and the man who governs their motions is 'the power,'" and I say, the fulcrum can be no where else but in the water. Here I must appeal to you, Mr. Editor; I have a great stake in my twelve propositions (inserted in your 397 number), depending on such points as this; and if I cannot establish this one fact, I shall be all in the wrong, and unable to go on. Should your decision be against B. C., his superstructure falls to the ground.* In a boat run aground, the fulcrum is certainly in the side of the vessel; it is then a struggle for the fulcrumship between the weight of the water upon the oar, and the adhesion of the boat to the ground; if the boat give way, the fulcrum will be in the water—if the water yield, the fulcrum will remain in the boat. 5th.—His diagram and explanation, page 30, are indisputable, provided he be left at liberty to place the abutment of his power where he please, in or out of the machine; but before I can pretend to discuss his statements, he must say where his abutment is to be, and in what line of direction his power is to act. I believe all mechanical power can be represented by a weight and intermedia; it is so represented in mechanical drawings. Let him therefore place his weight to indicate his power and its supporter, and then I will try the truth of his statements. There are many ways of propelling a carriage, such as pushing, rowing, pulling and forcing the wheels round, and I believe all of them may be represented by weights.

Fig. 2, No. 1, represents pushing a carriage; No. 2, rowing; No. 3, pulling or drawing it; and in every one of these, the fulcrum or abutment is on the immoveable earth, at A. B. C.; but it is with propulsion, by forcing the wheels round, that we have to do; and I request B. C. to place his weight accordingly. Perhaps it may save discussion if I make a few remarks on your correspondent's diagram as it stands; I may enlighten B. C.

In the first place, he states *a*, the fulcrum and centre of the wheel, and *c* the frame, to be immoveable, (I presume the power is a steam-engine fixed to the frame *a c*; but let your correspondent show this by a weight, and then there can be no mistake). The engine applied to *d* will certainly produce the effect he first mentions, and will be similar to Mr.

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* We consider Saxula to be, on this point, quite in the right.—Ed. M. M.

Gurney's carriage wheel in a rut, grinding, but not progressing. Remember the fulcrum, or abutment frame, and engine, are *immoveable*, and the resistance moveable. But will B. C. venture still to affirm it to be "equally clear" that the *same kind of power*, *acting at the same place*, *and in the same way*, will produce, as he infers it does, in a boat, a "relative position of things," when the fulcrum (as he says), frame and engine become *moveable*,[*] and the obstacle immoveable? I say, no! and will prove it, if he will locate his abutment and define the line of direction of his power in his diagram. The boat must be lifted out of the water to resemble this diagram; *a* must rise to *h*, because, by the question, *b* cannot sink to *e*. Archimedes said he could lift the globe, if he had a place to fix his machinery on, which was true in theory; and so could I controul its velocity in its orbit, had I a fulcrum in the ambient space. Just so will B. C. want a place out of the machine to abut his power on, to produce his second position.

Upon further consideration, the thing appears so plain to me, that I think I shall not again reply to B. C., except upon a fresh point; and I hope he will render it needless, by being candid enough to say he has mistaken his position.—Yours, &c. SAXULA.

March 19, 1831.

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CURE FOR HYDROPHOBIA.

Sir,—The *Morning Herald* for the 24th of February last, contains an extract from the *Maidstone Journal*, describing the "dreadful havoc occasioned by a mad dog" in that neighbourhood, which bit three persons, besides several dogs, sheep, and other cattle.

The extract goes on to say, "Mr. Wedd and Mr. Sedgwick of Maidstone, were sent for, who did every thing in their power to relieve the pain of the sufferers, and to obviate as far as possible the dreadful effects which too often follow the bite of a dog under such circumstances."

"The children also took the BIRLING SPECIFIC assented to by the professional gentlemen, for the purpose of easing the minds of the parents."

My object in thus referring to the account of this painful occurrence, is to introduce a few words on the subject of the SPECIFIC, there mentioned.

During the past summer, about the time that the inhabitants of the metropolis were almost distracted with the fears of hydrophobia, I made a short visit to the delightful village of Chislehurst, in Kent, eleven miles from London; and was very much surprised at the levity with which the villagers treated the bite of a mad dog. Curiosity instantly prompted me to ascertain what had occurred to disarm this dreadful scourge of its horrors; and, on inquiry, I found that it arose from a conviction in the minds of the inhabitants, on the efficacy of a medicine, known in that part of the country, as the *Birling drink*.

This *drink* is the BIRLING SPECIFIC, alluded to in the above extract. Upon pursuing my inquiries, I found that this medicine had been known in that part for years, and that the recipe for its preparation was a family heir-loom at present in the possession of an elderly couple, named Chapman, in a humble walk of life, residing at Birling, near Maidstone, whence its title. Considerable sums have been offered by medical men, and declined, for the recipe. As far as I can learn, it is made from British herbs, and is sold at so moderate a price, that it is within the reach of all classes. An old acquaintance whom I happened to meet, had himself been bitten some time back, by a dog in a highly rabid state; he set off, immediately after the accident, to Maidstone—procured, and took the medicine, and up to the present time has not experienced any ill effects from the bite. Some other individuals, personally known to me, had also been saved by the Birling Specific; and several respectable farmers informed me, that they had been in the constant habit of administering this medicine to their dogs and cattle when bitten, and always with uniform success; it is said that the medicine effects a cure, even after the first paroxysms have commenced; but of this no well authenticated fact came under my own limited notice.

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[*] Let B. C. carefully consider the nature of moveable abutments; no progressive motion can be had from an abutment absolutely moveable at the same rate as the power,—an abutment must necessarily be left behind; abutments only relatively moveable, furnish the means for progressive motion; such as the air for birds, water for fish and boats, bogs and sand for men and beasts. If B. C. can carry the abutment or fulcrum with him, what shall prevent his flying or climbing to the moon? If he thinks that abutment and fulcrum are different things, then he is, like Sterne's wig, below my art, and I have done with him.

If this medicine really possesses the virtue ascribed to it, (and for my own part, I cannot doubt the accuracy of my information,) it cannot be too generally known. If, on the contrary, there is no just grounds for the confidence placed in it by the men of Kent, the sooner they are undeceived the better; for this is certain, that their reliance upon its efficacy is so strong, that it would prevent them from attempting, by any other means, to obviate the dreadful consequences of hydrophobia.

Perhaps some of your readers at Maidstone can give some further information respecting this medicine, more particularly as to its result in the instance alluded to in the above extract.

Yours, &c. WM. BADDELEY.

March 18, 1831.

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AMERICAN SILK.

Sir,—Your readers will have probably observed the notice taken by Mr. Ewart, the ex-member for Liverpool (in the House of Commons, on the 15th of February) of the first importation of raw silk from the United States of America; and likewise a paragraph in the *Times*, of the 24th of February, on the same subject —a subject of sufficient importance to render a more detailed account interesting to the numerous readers of your widely-circulating journal.

M. Duponceau, of Philadelphia, the President of the American Philosophical Society, with his usual foresight and patriotism, long since thought of the advantages that might arise to the United States from extending the culture of the white mulberry-tree, and the propagation of the silkworm, for which the great variety of soil and climate prevailing in these states offers great facilities. But difficulties arose in preparing the silk for the market, which, for a long time, retarded the accomplishment of his views. The earliest successful result was the manufacture, in Connecticut, of sewing silk of superior fineness and strength.

Mr. D'Homergue, of Nismes, in France, paid a visit to Philadelphia, and afforded M. Duponceau an opportunity of carrying his laudable designs into practice by establishing a filature under his direction; Mr. D'Homergue having previously managed one in Nismes, and seen a good deal of the culture and preparation of silk in France, felt sanguine of its success in America. The result of the first trial has shown that their labours are likely to be crowned with success.

It was not to be expected that the American operatives first employed in a new, and, to them, strange process, should turn out of their hands an article as well prepared as that furnished by Italy or France, where it has been so long the staple of the country. Yet the sample received has shown that Mr. D'Homergue's lessons have been addressed to willing and apt scholars, who will, it is hoped, soon equal the reelers of France and Italy.

It may now be stated that an intelligent gentleman has tried a sample of this silk, in the different processes of winding, throwing, and dying, and the result is highly satisfactory—so much so, that he thinks a fine field is open for the culture of the article in America. In quality, he considers it superior to India silk generally, and fully equal to that of Friuli or Trent. He had some of it dyed black (the colour which most tries the silk), and this it takes very well. He concludes by suggesting some improvements in the reeling, which a little more practice may soon effect.

The present importation is a mere sample, being a very small package, and was produced (as the correspondent of the *Times* states) in Pennsylvania, and reeled from the cocoons in Mr. Duponceau's filature at Philadelphia, under the directions of Mr. D'Homergue. It has been submitted to some of the best judges in this country, who think it is a very fair beginning. The texture is finer than the Italian silk, and it produces a larger return from the same quantity of cocoons.

Some silk from the same filature has been boiled, dyed, and woven into very fine stuff in America; although not thrown, as they have no throwing mills at present there.

Should the production of silk increase as rapidly in America as cotton has done in the last thirty years, it will become an article of great consequence in our trade with that country; the Americans sending the raw material, and taking back the manufactured article in return, as is now the case with cotton.

The white mulberry-tree, and silkworm, are said to succeed in almost all the States of the Union; and the latter can be brought forward at the time the former is in leaf.

This subject has been taken up by a committee of the Congress, and strongly recommended by them to the attention of the American government and country. And any object that will promote the intercourse, or strengthen the ties between the two countries, is well deserving the attention of both.—Yours, &c. * *

London, March 26, 1831.

NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

Fire-Escape, *Lieut-Col. L. Walker.*—The construction of this escape is explained by an elaborate specification, and by a reference to numerous plans, elevations, and sections; but we are saved the trouble of extracting the essence of them by the following description of the invention, with which we have been favoured by a friend, who witnessed a successful experiment with it in the Strand on Monday last:

" The part to which the tackling is attached, has the appearance of a small crane, firmly braced, projecting from the window from which a person is desirous of descending. It is easily fixed to the window frame, and has a firm abutment on the sill, and the rotary motion of the projecting arm is prevented by a bar of wood crossing at a convenient height, and held firm by the side frames. At the extremity of the projecting arm is a cross piece, forming a T, at each extremity of which is a pulley running on its fixed axis; and a line being carried over, those two pulleys, they become in principle balances or levers of equal arms, on which equal weights suspended at the opposite ends of the lines will be in equilibrio. To one end of this line is attached a frame or bag, with a circular bottom of wood for a person to stand on, the bag is distended with hoops, and has an opening on one side, to facilitate the entrance of the person descending. An iron vessel or bucket is suspended at the other end of the line, containing weights at pleasure. Those used in the experiment I witnessed, were marked 3 stone weight, (I suppose 42lbs.); when the frame or bag is elevated to the window, the weights are on the ground, and *vice versa*, the one ascending as the other descends; the rope is also continued from the bottom of the frame and vessel containing the weights, forming an endless line, and enables the persons below to assist the motion in either direction, or remove obstructions: from the middle point of the T of the projecting frame, another line is fixed, which reaches to the ground; on this line at short intervals (say 10 or 12 inches) are knots and small pieces of wood through which the line passes, which serve to insure a firm grasp of the rope, and prevent it sliding through the hands. This apparatus being at hand, the crane is projected from the window, and expeditiously and securely fixed; the vessel containing the weights is lowered; and the frame in which the person is to descend hangs close to the window. A short line attached to the frame and carried two or three times round a pin with a T head in the fixed frame, prevents its giving way on the person stepping into it: meantime the person entering it, with one hand grasps the immoveable rope before described, and with the other releases the short rope from the pin, and as his weight is greater than that of the counterpoise, he of course descends; but to prevent the descent from being accelerated, he has it in his power, by clinging to the fixed rope, to restore an equilibrium, by throwing a part only of his own weight on the fixed line or point to which it is affixed. For simplicity of form, safety in its use, and expedition in application, the whole apparatus does great credit to its inventor."—*Date of Pat. Oct.* 6, 1830; *of Spec. Feb.* 6, 1831.

Packing and Transporting Goods, *Sir C. Webb Dance, of Hertsbourne.*—The goods are to be packed on a platform, and lifted by means of this platform and a crane in connection with it, when it is desired to transfer them from a waggon to a barge or from a barge to waggon. The specification mentions several auxiliary contrivances, by which this mode of transferring goods *en masse* may be facilitated. *Date of Pat., Aug.* 5, 1830; *of Spec,. Feb.* 5, 1831.

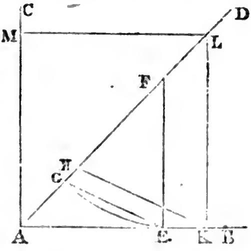
Mode of Constructing Iron Wheel Barrows, *W. Mallet, Marlborough-street, Dublin.*—The patentee claims the merit of manufacturing much lighter and cheaper iron barrows than those in common use. We hope he will be no loser by this expensive mode of advertising his superior skill in wheel-barrow making; in the mode of construction itself there seems to us to be nothing new.

(To be continued regularly.)

THE SUPPLEMENTARY PROBLEM IN NEWTON'S APPENDIX TO EUCLID.

Sir,—Mr. Wm. Pearce, in No. 362, requested the aid of some of your contributors in solving three geometrical problems under given restrictions, taken from Mr. J. Newton's appendix to Euclid's Elements.

The first is :—Given the difference between the side and diagonal of a square to construct it, without the aid of any principles ulterior to proposition 23, book 1st, of Euclid's Elements. Mr. Samuel Simple in No. 395, informs Mr. Pearce, that if he (Mr. P.) has mastered the 6th proposition in Mr. Newton's Appendix, he will find no difficulty in solving the 23rd, &c.; confessing, at the same time, that he (Mr. Simple) cannot solve the said proposition himself, under the required restrictions, and does not believe it can be done. Well; be that as it may, Mr. Pearce is certainly not made one whit wiser by Mr. Samuel Simple's communication. But the truth is, the problem *can* be constructed under the given restrictions, and also independently of the 6th proposition of the appendix.



Construction.— From the point A in the given straight line AB, draw AC $\perp$ to AB, and bisect the angle BAC by the straight line AD. In AB take any point E, and draw EF, $\perp$ to AB meeting AD in F, and from the centre F and distance FE describe a circle meeting AD in G. Join GE and make AH equal to the given difference. Between the diagonal and the side of the required square, and at the point H in the straight line HF make the angle FHK = angle FGE, and let HK meet AB in K. Draw KL, $\perp$ to AB meeting AD in L, make AM = AK join ML; then shall AKLM be the required square.

Thus, so far as the construction is concerned, we have confined it to the required limits, and have therefore fulfilled the requisite conditions. The demonstration (which is very easy) will certainly require an extension of the propositions in the first book, as far as the 32d.

Some of your very rigid geometrical contributors might cavil about one of the steps in the above construction, by saying that it should have been proved, that HK will meet AB.—This is easily demonstrated: for since the $\angle FHK = \angle FGE \therefore$ the $\angle KHA = \angle EGA$ (13 and 1st Elements); but the angles EGA and GAE are together less than two right angles (17 and 1st), $\therefore$ the angles KHA and HAE are together less than two right angles. Hence (Ax. 12 and 1) HK and AE will meet if far enough produced, &c.

In due time I will send you a solution of the second problem.—Yours, &c.

KINCLAVEN.

WATERPROOF COATING.

Sir,—As you were so good as to insert my communication to you respecting metallic coating, and say (in your No. 396, p. 32) that you know more than one person who would be glad to hear "further particulars," I proceed to inform them, through your pages, that it may be had of various colours to match stone or brick walls, or cover wood or iron; but where there is no objection to *black*, the composition of that colour comes the cheapest. If it were spread on a flat roof, and slates laid thereon, such a roof would last many years. Cisterns, neat and durable, might be constructed in this way; and if a tiled cellar floor were laid in it, such an one would be free from dampness, though in a wet foundation. The stone colour is excellent for covering Roman cement fronted houses, and the red for gable ends of brick houses, subjected to dampness. For such purposes, and various outdoor work, nothing hitherto applied, that

I have ever seen, is equal. For the bottoms of ships it is peculiarly applicable, and I have no doubt would prevent copper sheathing from corrosion. Such rust being, as I take it, a mixture of white muriate and green carbonate of copper,—arising from decomposition of salt water, and the black coating resisting acids, it would cut off all communication between the copper and that which causes its decay, and for the same reason would prevent copper sheathing from acting on iron bolts, as any consistence may be given to it. With respect to its probable duration, time only can show; but if I were to form a guess (from what I have seen above three years old) I should say about ten years. The article is made by a Mr. Greetham, of Chester, who would doubtless pay the same attention to all applications as he did to that of

An Original Subscriber.

Liverpool, March, 1831.

◆

MINOR CORRESPONDENCE.

Smith's Metallic Chimneys.—W. N. is not satisfied with the propriety of our omitting part of his letter which respected the originality of Mr. Smith's invention (see No. 394, p. 463); and challenges us to point out one single sentence in our description that disapproves of the right of Mr. S. to the patent. We accept his challenge. At the close of the description, we observed, "That there is much novelty in the adoption of iron flues, can scarcely be affirmed; for such flues have been made use of for the conveyance of smoke, time out of mind; and in every possible situation—heart of brick and stone walls not excepted. The damper, too, may be considered as only the blown bladder, in a form of greater mechanical exactness." Can any thing be plainer? W. N. does not surely require to be informed, that to question the novelty of a patent is equivalent to questioning its validity.

Perpetual Motion.—Your correspondent, Robert Twiss, Jun., p. 444, states a proposition which, if true, will certainly demonstrate the possibility of perpetual motion. The proposition is, "That a wheel can be made to possess more force in its first revolution, than is in the spring that moved it." To this I demur; and think his demonstrations only tend to prove, that 1000 small wheels will require more power to keep them in motion than 1 wheel, of bulk equal to the 1000 wheels. I am not sure that I quite understand his experiments; but believe the small wheel was stopped by less comparitive weight than the large wheel, because the weight on the large wheel was more increased by the accelerated motion of falling bodies, a quality which may have been overlooked by Mr. Twiss. If a particular wheel possess the properties named in the proposition, should it not raise the weight that set it in motion higher than the starting point? which is contrary to known experience.—Yours, &c.

Saxula.

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MISCELLANEOUS.

Age of Ships.—The *Royal William* was launched in 1719, and is supposed not to have been repaired till 1757; it was surveyed afloat in 1765, and probably lasted many years more. The *Betsy Cains* yacht, in which King William performed his first voyage to England, was then several years old; it was sold to a merchant in the reign of George I., and employed in the coal trade, in which service she existed till February, 1827, when she struck on a reef of rocks near Tynemouth Bar, and was there lost, only for want of timely assistance, her timbers being, after the lapse of, at least, one hundred and forty years, still perfectly sound. How is it that no such ships are built now-a-days? Is it the dry-rot, or underwriting, that flourishes?

Grand Tunnel.—A petition has been presented to the President of the United States, signed by 78 members of Congress, for the aid of 1000 troops to carry the Chesapeake and Ohio Canal, by means of a tunnel, through the summit of the Alleghany Ridge of mountains. This tunnel is to be four miles long, and will overcome a rise and fall of 700 feet; should this be accomplished, it will be the largest tunnel in the world.

◆

NATIONAL REPOSITORY, for the Annual Exhibition of New and Improved Productions of the Manufacturers of the United Kingdom, in the Gallery of the Royal Mews, Charing-cross.

Patron—The KING.

Artists, Manufacturers, Patentees, Modellers, Mechanical Draughtsmen, &c. &c., are requested to notice that the arrangements now in progress for the immediate opening of the Fourth Annual Exhibition to the Public, renders it highly important that the Specimens intended for Exhibition this present Season should be sent to the Repository without delay.

In consequence of the grant made by his Majesty's Government of the use of this Public Building for the purpose of promoting and encouraging New Inventions and Improvements in the Arts, Sciences, and Manufactures of this country, no fees or charges of any kind are made for the Exhibition of any New Invention or Improved Production in the National Repository; and all specimens sent are delivered back to the owners at the close of the exhibition.

T. S. TULL, Secretary.

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INTERIM NOTICES.

With this No. is published an Appendix to Vol XIV., price 3d., containing solutions of all the mathematical questions which appeared in the course of that volume, and remained at the close of it unanswered: and also some original tables of great importance to all who are practically concerned in Steam Navigation.

Next Saturday the Supplement to Vol. XIV., including Title, Preface, Index, and a Copper-plate Engraving of Autographical memorials of eminent men of Science, Engineers, Mechanics of the Nineteenth Century, Price 6d.

T. A. asks too much.

Communications received from Mr. Davy.—Mr. Baddeley.—Nauticus.—Mr. J. Eyre.—A Constant Reader.—Mr. Ralph Lindsay.—Mr. Fowler.

Errata.—In last No. p. 62. col. 2. l. 8. from the bottom, for "20 years," read "*n* years."

P. 63. col. 1. l. 5. from the bottom, after the words "the base," insert "and the perpendicular."

P. 84. l. 19 and 21, for "Thevithick," read "Trevithick."

LONDON. Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

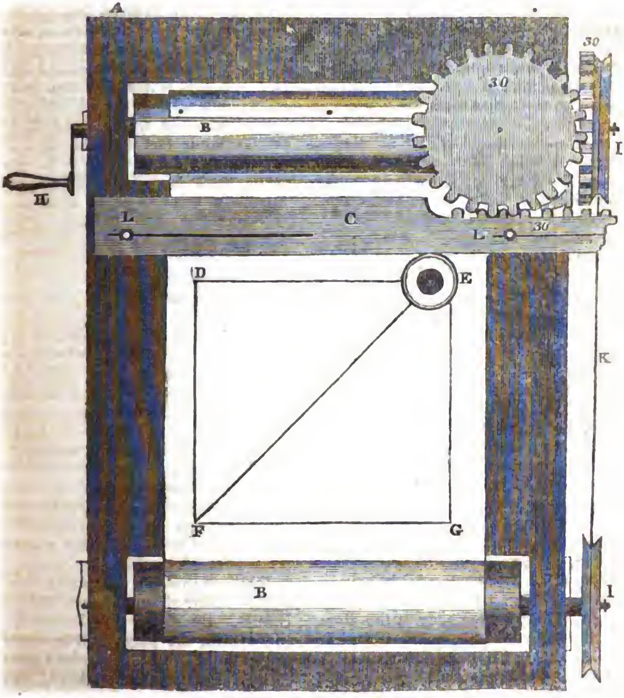
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 400.] SATURDAY, APRIL 9, 1831. [Price 3*d*.

"There walks a spirit o'er the peopled earth,
Secret his purpose is, unknown his birth;
Moody and viewless as the changeful wind,
No force arrests his foot, no chains can bind.
Where'er he turns, the human brute awakes,
And roused to better life his sordid hut forsakes;
He thinks, he reasons, glows with purer fires,
Feels fewer wants, and burns with new desires."—Mrs. Barbauld.

THE BIPELLO, OR MACHINE FOR THE ILLUSTRATION OF COMBINED MOTION.



DESCRIPTION OF THE BIPELLO, OR MACHINE FOR THE ILLUSTRATION OF COMBINED MOTION.

Sir,—The accompanying drawing exhibits a front view of a machine lately contrived by me for the illustration of combined motion, usually called the doctrine of central forces. The machine commonly in use, and that which is generally referred to, both by experimental lecturers and by the treatises on the subject, consists of two moveable wooden frames, one of which is made to slide laterally within the other, by means of a groove in the exterior frame, and of a well-known arrangement of wire, pulley, and thread, by which, on pulling out the interior, a small ball is made to ascend on this thread in the diagonal of the frame.

Before giving a description of my improved apparatus, it may not be out of place to give a short preliminary view of that doctrine of motion which it is the object of the machine to illustrate.

All bodies have a tendency to continue in the same state of rest, or of uniform rectilinear motion, unless some change be produced by external force; this is called the inertness or *vis inertia* of matter. A body, therefore, at rest, will continue so for ever; and if it once be set in motion, it will move for ever unless its motion be retarded, and destroyed by some external obstacle. The change in the actual state of a body from rest to motion, or from one kind of motion to another, is always in proportion to the intensity of the acting force. This law is the foundation of all curvilinear motion; if, when a body is in motion, a force be applied to it in the direction in which it moves, two or three times greater than that which had just set it in motion, its velocity will become two or three times greater, &c. To every action is always opposed an equal reaction, or, in other words, the mutual actions of two bodies on each other are always equal, but in contrary directions. If we see a body moving in a curvilinear direction, we are certain that this body is acted upon by two forces differently directed. When two forces differently directed act upon one body at the same time, the body will not move in either direction, but will move forward in a diagonal, between the direction to which it is impelled by each force. This last mentioned principle, the machine demonstrates· let us now proceed to describe its several parts and manner of action.

A, A, A, A, is a strong oblong frame of wood, about fifteen inches long, twelve inches broad, and about one inch thick. At each end a piece is cut out of the frame, sufficiently large to admit one of the cylinders, or rollers B, B, to turn freely within it; C is a horizontal bar of brass, having a row of thirty teeth cut on its end; it is raised as far above the frame as to be flush with the wheel that drives it. This bar has slits or grooves cut into it at each end in the direction of its motion, and into these, two pins LL, with large heads, are inserted, which pins are made fast into the strong frame, as shown in the drawing. The purpose of these pins is to keep the motion of the bar always parallel; they must not fit tight into the grooves, but be so easy that the bar may move with freedom when the machine is in motion. D, E, F, G, is a square drawn on a long sheet of paper, that is made fast to both rollers, and is seen in the engraving nearly wound off the upper one. I, I, are pullies made fast to each end of the rollers, and by the band K working them, serve to tighten the paper, and give it a more equable motion. The vertical wheel of thirty teeth on the end of the upper roller drives a similar wheel of thirty teeth in a horizontal direction, the teeth of which last take into the teeth in the bar, and give it a rectilinear motion. The bar has a circular arm attached to it at E, on which a long tube, holding a pencil, is erected, which pencil is made to press gently on the paper underneath, by a small plug of lead which slides into the tube, and bears on the top of the pencil. By giving the handle H its proper motion, it will wind from off the lower of the two rollers a quantity of paper equal to their circumference; the square D, E, F, G, should correspond in size to their circumference. The bar C, having the same quantity of teeth per inch as the other wheels, will, in the time that the rollers take up paper equal to their circumference, move from E to D. By giving the handle H one entire turn, the paper will be wound off from the under roller to the upper one, and at the same time the bar C, with its pencil E, will move from E to D, and instead of the pencil going in the horizontal straight line E D, by unwinding the paper from the roller, it will be found to have traced a line in the diagonal of the square D, E, F, G, from E to F—demonstrating, that if a body be acted upon by two forces, one of which tends to send it in the same direction (as the pencil E, from E to D)—and the other in the direction of from F G to D and E, the body will move along in a line between them, as from E to F. This may also be exemplified in a more familiar manner, by making a person draw a sheet of paper from another who holds a pencil, and requiring him to draw on it as straight and horizontal a line as he possibly can. The same result as in the machine will be produced, though perhaps not so accurately.

Every modification of apparatus which tends to make clearer any point in science is of importance as well to teachers as learners. Should the present machine prove to be of the least use to the readers of the Mechanics' Magazine, the intention for which I send it for insertion will be fully accomplished—I am, Sir, Yours, &c.

EBENEZER HENDERSON.

Duke-street, Liverpool, Feb. 24. 1831.

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HISTORY OF MARITIME AND INLAND DISCOVERY.*

We have now before us another interesting and most instructive work, which has been called into being by that excellent undertaking, Dr. Lardner's "Cabinet Cyclopædia." It is a history of the progress of geographical discovery by land and sea from the earliest to the present times. Two volumes of it have been for some time in print; the third and last has only just been published. As the public has already set its seal of approbation on the former, and we see no reason to quarrel with its award, we shall confine our critical attention to the latter, which, we are glad to say, is in every respect worthy of its precursors.

The contents of this last portion of the work can hardly indeed be so novel or so marked by deep research as those of the earlier volumes; inasmuch as they embrace the detail of events, recent in date and comparatively familiar to the general reader. The ever-during interest of the materials, however, makes up for this deficiency of novelty, and Mr. Cooley has made so good a use of his opportunities, and brought together within a small compass so vast a mass of useful and entertaining facts from a great variety of sources, that we feel free to congratulate him on a termination to his work, quite as brilliant as the commencement promised.

We have, first, a very well-written chapter on the progress of geographical science, forming a very apt introduction to a volume on the labours of those, by whose exertions during the last century, that branch of science has been brought to its present state of perfection. The anecdotes of the enormous blunders of the old map-makers are extremely amusing, and at the same time, serve to show what an intensity of light has been directed on our knowledge of the world in the last two reigns. The voyages of Byron, Wallis, and Cartaret follow—after which Cook appears upon the scene, which he, of course, continues to occupy for a considerable time. His well-known adventures are sketched with a considerable degree of graphic power, and, as far as we have observed, with correctness. We must observe, however, that the designer of the vignette, the death of Captain Cook, gives a different version of the affair from Mr. Cooley—a discrepancy which should have been avoided.

The three voyages of this immortal navigator are naturally followed by that of La Perouse, the unfortunate French captain, whose fate was enveloped in such doubt, until the mystery was cleared up by the researches of the English captain Dillon, under the protection, and at the expense, of the English East India Company—of which researches we have here a succinct and highly interesting narration. A chapter succeeds, entitled "Europeans in the South Sea,"—and this is, we think, the best in the whole work. Isolated facts respecting the adventures of those Europeans who, by some "accident of flood or field," have been left on some of the Polynesian islands, are scattered up and down an immense mass of works, and it must have required very considerable knowledge of the subject, gained by a *con amore* course of reading, together with much industry and talent, to produce the interesting and instructive chapter in question. But we do not wish this opinion to be taken on trust; a specimen or two will suffice to show that we do not appreciate this portion of our author's labours so highly without reason. After giving a short but circumstantial detail of the mutiny of the Bounty, and the extraordinary voyage of Bligh, he narrates the subsequent voyage of the Pandora to chastise the mutineers, and after accounting for the fate of all but eight, he proceeds as follows:—

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* The History of Maritime and Inland Discovery, by W. Desborough Cooley, Esq. London, Longman and Co., John Taylor; 3 vols., small 8vo. 1830-31.

"No tidings could be met with respecting Christian and the seven mutineers who had sailed with him in the Bounty, and twenty years passed over before any clue was found to the mystery of his fate. At length, in 1808, Captain Folgar, commanding an American trader, touched at Pitcairn's island, to complete his cargo of seal-skins. He supposed that the island was uninhabited, but, to his surprise, three young men who spoke English well, came off to the ship in a double canoe with a present of fruit and a hog. They said that their father was an Englishman, who had sailed with Captain Bligh; and Captain Folgar, on landing, saw an Englishman named Alexander Smith, who had been one of the crew. He was the only one of the mutineers who remained alive, the rest having been murdered by the Otaheitean men, who were immediately after sacrificed to the vengeance of the widows.

"Smith appears to have been uneasy at the discovery made of his retreat, for in all subseqoent accounts he appears under a changed name. In 1814, Captain Staines fell in with Pitcairn's Island, and found, to his astonishment, that all the inhabitants, forty-six in number, spoke good English. A venerable old man, named John Adams, was the patriarch of the community, or rather family, in which no germs of discord or vice had yet found place. The eldest born on the island was the son of Christian, and was baptised Thursday October Christian. Old Smith or Adams, was at first much alarmed lest the English were coming to apprehend him; but this fear once dispelled, he and his people expressed the most extravagant joy at the sight of those whom they were pleased to call countrymen.

"The young natives of Pitcairn's or Christian's Island are beautifully formed, uniting the vigour so common among the islanders of the South Seas with features decidedly English. The women, in particular, are remarkable for their majestic carriage and matchless symmetry; they are, at the same time, modest, innocent, and cheerful. The houses on the island are well built, and neatly furnished with beds and bedsteads. A supply of instruments, such as spades, hatchets, &c., was made from the iron in the Bounty, which was broken up for that purpose. The ground was cultivated by both sexes; the first colonists availing themselves of European seeds as well as of the native productions of the South Sea. Old Adams kept a journal, in which he entered minutely the quantity of work done by each individual; and, besides private property, there seemed to be a general stock; and, perhaps, it may rather be concluded that, in the infancy of society, the whole community feels a nearer interest in the industry and welfare of each of its members.

In 1822, a whaler which touched at Pitcairn's Island, found that its population had increased to seven families, consisting of fifty-three persons. Adams and six Otaheitean women were all that remained of the original settlers. There were eleven active, vigorous young men, able and willing to assist a ship in obtaining a supply of wood and water. They were observed to be very exact in their religious observances, and to fast rigidly on Friday. The children also wore crosses on their necks; but though resembling the other South Sea Islanders in the simplicity of their lives, the natives of Pitcairn's Island are quite exempt from the vices of the barbarous state, and are perhaps destined to exert one day an influence on the scattered inhabitants of Polynesia, proportioned to their physical perfection and their aptitude to learn."—p. 116.

We are aware that much of this has appeared before — enough, indeed, to take away the charm of novelty; but still, we believe that *the whole* of the facts here brought forward have never before been brought together, or the story given with so much brevity and simplicity, or brought up to so late a date. * We notice one or two inaccuracies; for instance, Christian's son was not named

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* Since writing this notice, "The Voyage of Captain Beechey" has appeared, which calls for some qualification of the above remark, as the captain gives a still later account than Mr. Cooley of the inhabitants of the island, with a portrait of John Adams, and many new particulars of the settlement; some of these particulars we shall probably extract in a review of the voyage which we have in preparation.

Thursday October, but Friday Fletcher October Christian. This fact we glean from a very curious little work, "The Briton's Voyage to Pitcairn's Island," written by a Lieutenant Shillibeer, who sailed with Captain Staines in that frigate in 1814; and, after his return, amused his leisure by writing the narrative of the voyage, and etching, in a homely-enough style, some score of illustrative plates—among others, a portrait of the personage in question, from which it would appear, that his countenance is not "decidedly English," but partakes of the Indian cast of feature. Mr. Cooley would have done well to consult the lieutenant's book; which, however, having been published in a country town, is not very frequently to be met with. It is a great curiosity in its way, and the plates great curiosities in theirs; one of them is a view of Juan Fernandez (Alexander Selkirk's island), printed in ink formed of the red soil of that island!

To return to the "History of Maritime Discovery"—in the same chapter we have a sketch of the trade carried on in the South Seas, and the consequences of the manner in which it is conducted.

"The European shipping in the South Sea is chiefly engaged in the whale fishery, in the fur trade, and in the trade for sandal-wood, and other tropical productions. The spermaceti whales have been already pursued round the globe, but there is no part of the ocean so remote, as to afford them a shelter from the perseverance and cupidity of man. The visits of the whales are chiefly confined to the islands of the Southern Pacific. The trade in sandal wood, which is carried on in the Feejee and Friendly Islands, is, from the nature of the shipping employed in it, perhaps the most demoralizing of all. Small colonial vessels, fitted out by needy adventurers, carry on a large portion of this commerce unrestrained by any national or moral considerations.

"The fur trade carried on with the north-west coast of America, has effected a wonderful revolution in the Sandwich Islands, which, from their situation, offered an advantageous shelter for shipping engaged in it. Among these islands the fur traders wintered, refitted their vessels, and repaired their stock of fresh provisions; and, as summer approached, returned to complete their cargo on the coast of America. Iron tools, and above all, guns, were eagerly sought for by the islanders in exchange for their provisions; and the mercenary traders, regardless of consequences, readily gratified their desires. Fire-arms and ammunition being the most profitable stock to traffic with, were supplied them in abundance. Hence the Sandwich Islanders soon became formidable to their visitors; they seized on several small vessels, and displayed an energy tinctured at first with barbarity, but indicating great capabilities of social improvement. At this period, one of those extraordinary characters which seldom fail to come forth when fate is charged with great events, completed the revolution which had its origin in the impulse of the Europeans. Tame-tame-hah, a chief who had made himself conspicuous during the last unfortunate visit of Cook to those islands, usurped the authority of king, subdued the neighbouring islands with an army of 16,000 men, and made his conquests subservient to his grand schemes of improvement. He knew the superiority of Europeans, and was proud to imitate them. Already, in 1796, when Captain Broughton visited those islands, the usurper sent to ask him whether he should salute him with great guns. He always kept Englishmen about him as ministers and advisers. In 1817 he is said to have had an army of 7000 men, armed with muskets, among whom were at least fifty Europeans. Tame-tame-hah, who began his career in blood and usurpation, lived to gain the sincere love and admiration of his subjects, who regarded him as more than human, and mourned his death with tears of warmer affection than often bedew the ashes of royalty."—p. 121.

This Tame-tame-hah, or, as his name is more usually written, Tammeamea, was the father of the king of the Sandwich Islands whose visit to England and death excited a "sensation" some few years ago. Rheo-rheo, or "the Dog of Dogs," as that name signifies, was by no means so great a man as his father, the founder of the dynasty—who, in truth, is dismissed too unceremoniously, for the life of a savage chief, who in the course of his single lifetime, raised his dominions from absolute barbarism to some degree of maritime and commercial power,—who, in fact, was the Peter the Great of the South Sea—could not have been otherwise than interesting. The shrewdness, the foresight, the aptitude for imitation of civilized manners and customs, and even, we might say, the statesman-like views, of Tammeamea, demanded the appropriation of a whole chapter, and that chapter might not have been the least entertaining in the book.

The "Coasts of Australia" next come under notice, and here again is much to amuse. The adventurous spirit of Bass, the discoverer of the straits which bear his name, and of his companion, Flinders particularly arrests the attention. What can be more daring than the conduct of these two adventurers?

> "Seven years after the establishment of the colony, Captain Hunter was appointed its governor; and in one of the ships which accompanied him to New South Wales were two young men, Messrs. Flinders and Bass, the former a midshipman, the latter a surgeon in the navy, both enthusiastically bent on exploring unknown countries. In preparing an expedition, however, for this purpose, they were left wholly to their own resources, and were unable to provide themselves with any better vessel than a boat eight feet long, to which they gave the name of Tom Thumb. In this our bold adventurers embarked, with only a boy to assist them. Directing their course to the south, they examined minutely every little cove along the shore, and explored George's River, about twenty miles beyond the extension of the Government survey: the report which they made, led to the establishment of a colony on the banks of this river. In the following year, 1796, they again put to sea in the Tom Thumb; and, after encountering numberless difficulties and dangers, arising from the slenderness of their means and the frailness of their vessel, they returned with no result of their voyage but a minute practical acquaintance with a long line of coast. They had also given such proofs of courage, skill, and perseverance, as recommended them to be chosen as the instruments of important discoveries."—p. 127.

The discoveries in the interior of New Holland are brought up to the very latest dates, and the account of the Swan River settlement is even prophetic—for it states it to be most flourishing—a representation hardly warranted by the last accounts.

After Australia, we are presented with narratives of the travels of the Americans in the interior of the northern continent, with those of Hearne and Mackenzie, which naturally led to the voyages of Ross, Parry, and Franklin, whose ponderous tomes are very neatly abridged—no small service to those who cannot spend their whole time in the "pursuit of knowledge." Humboldt's Travels are next in succession; but that scientific traveller's researches are of more interest to the philosopher than the general reader. Much information is then brought to bear on the southern extremity of America, and the eastern shores of Asia, two of the most obscurely-known spots on the globe—and, after a chapter on "Travels in the Himalyeh," the highest mountains in the world, the whole concludes with the attempts of Bruce, Mungo Park, Denham, and Clapperton, to pierce to the interior of Africa,—attempts which, however unsuccessful in their proximate object, have added much to the general stock of knowledge.

We believe this is Mr. Cooley's *first* appearance as an author, but we feel sure it will not be for want of adequate encouragement if he be not a long and prosperous sojourner in the demesne of popular literature.

NORTON'S RIFLE SHELL.

"Inventors, like prophets, are rarely valued in their own country. In the year 1824, Captain Norton, of the 34th regiment, invented a small shell of the diameter of the usual musket-ball, and so constructed as to explode by percussion on being fired from a rifle against any firm board of from two to three inches thick, at the distance of three hundred yards. This missile he proposed, should be employed for the purpose of blowing up ammunition waggons, tumbrels, or generally for effecting any explosion of which its powers admitted; and, having satisfied himself by repeated experiments of the truth of his theory, he submitted the shell in the year 1826 to the inspection of the chief officers at Woolwich, before whom its efficiency was made fully evident. These officers, however, stated, that they did not think it could be advantageously introduced into the British service, and Captain Norton was accordingly informed to that effect.

"In the year 1825, M. Delvigne, a lieutenant of infantry in the French service, and who, like Captain Norton, had been unsuccessful in his endeavours to make the French Board of Artillery sensible of the advantages of a rifle which he proposed for adoption in the French army, heard by accident, that successful experiments had been made with a rifle-shell; and, about a year afterwards, was fortunate enough to get a sight of one. Immediately adopting the idea, he had similar balls constructed; and, again bringing his rifle forward with this accession of power, at length succeeded in getting a fair trial from the Artillery, 1829. The result equalled the most sanguine expectations, and M. Dalvigne was ordered to prepare four thousand shells for the African army, then about to sail. These shells were used at Algiers with the greatest effect; and this formidable addition to the destructive engine of modern war, will now most probably form a fixed portion of the ammunition of the French army. That M. Delvigne's is identical with Captain Norton's shell there can be little doubt; indeed, the former honestly lays no claim to the invention, as appears from his statement published in the *Spectateur Militaire* for December last."—*United Service Journal for April.*

We extract from a preceding No. of the same Journal, to which we are indebted for the above notice, the following description by Captain Norton of the manner in which his shell is constructed.

"The balls or shells that I use are somewhat of an oblong form, in order to prevent their turning over in the barrel as a musket-ball does, and taking the rotary motion instead of the spin the rifle is intended to give. In casting the shells, a small iron or brass rod is fixed in the mould through a hole directly opposite the one through which the melted lead or solder is poured; the rod, being taken out the hollow part of the shell is formed, into which a small tin tube with a copper cap on it, and filled with fuze composition or gunpowder,* is inserted, so far that the cap may inclose half its length in the shell; the edge of the orifice is then easily closed round the cap, by turning and pressing it in the aperture of the mould; the tin tubes are left about one-third open, in order to conform to the hollow of the shell and the size of the cap; if the bottom of the shell is about the sixth of an inch thick, it will be strong enough to resist the explosion, and to force the flame forward. As these shells fit readily into the grooves of the rifle, little force is required in pressing them home, and if the head of the ramrod is hollow, and fits the calibre of the rifle, it cannot possibly touch the copper cap, but presses only on the shoulders of the ball. A powder-charger made to screw to the end of the ramrod answers perfectly for this purpose, and it can easily be carried in the trap in the butt of the rifle; the shells being made of pewter or solder, preserve their shape after passing through even a hard board, and may be fresh charged and used many times, if fired into a wooden box. Very thin linen or cotton cloth patches, well greased, should be used in loading, as being uninjured or cut in ramming home, they prevent the leading of the rifle: it is not so with a ball which is *forced* in; the patch is then cut by threads of the rifle and the leading takes place. Although the original intention of these shells was to blow up ammunition waggons, yet I think they might be used for other purposes, such as exploding mines, &c.; with a rifle of the calibre of the military one, they will be effective as far as four hundred yards, which I have proved by trial. If a rifle has three, six, nine, or twelve grooves, equally cut, a shell cast with the equally-divided projections on it will fit into any three grooves of the rifle, and assuredly take the spin; but the ball should also be a little oblong in its form. Rifles that load at the breech are particularly suited for these shells, as in that case they can be cast with a smooth surface, and will take the spin without the necessity of projections on their sides; whatever thickness the boards may be of that these shells penetrate, the flame will be carried through. There are two deal planks at Mr. Moore's, the gun-maker in St. James's-street, each three inches thick, through which I exploded gunpowder at the distance of sixty yards, with one of these shells fired from a common military rifle.

"Another advantage from loading with balls fitting into the grooves is, that the front of the ball preserves its proper form for *boring* the air; whereas, if hammered or forced in the usual way, the front is disfigured and indented by the ramrod; the charge of powder can also be increased to any strength required, and the ball will still follow the spiral turn of the grooves; but if you increase the charge of powder in the present way of loading, the ball will pay no respect to the spiral grooves, but fly over them stripped and disfigured in its shape. A rifle that loads at the breech possesse the same advantages, that is, the proper form of the front of the ball, and of not stripping. The best rifles that I have seen for breech loading, are those made by Bevan; that they are quite safe I have proved, by firing three balls at a time all a tight fit.

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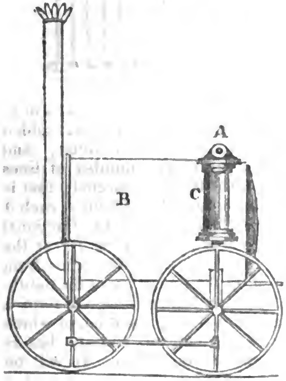
* Fuze composition is made up of dry fine mealed saltpetre and gunpowder, rammed down very hard. When the bullet is made of pewter or solder, the tube may go nearly through, so as to leave about an eighth of an inch solid.

"Although the most obvious way to make a mould, to cast either shells or balls to fit into the grooves of the rifle, is, to insert a small section of the rifle barrel within it; in this case the grooves are cut straight in the mould, and the tables of the barrel press on the angles of the projection of the shell or ball, and ensure the ball taking the spin by acting more completely on its periphery."

BADDELEY'S PENDULUM LOCOMOTIVE-ENGINE.



Sir,—You will guess I was not a little surprised in finding, in this week's Mechanics' Magazine, (No. 398) a description of a pendulum steam-engine of American invention, when I inform you that I have been engaged for some time past in arranging a somewhat similar contrivance. My plan was, however, more particularly intended for the purposes of locomotion; and I now enclose a rough sketch, illustrative of the manner in which I proposed to construct a pendulum locomotive steam-engine. In this representation, B is the boiler; C, the cylinder, which, instead of being fixed and accompanied by parallel motions, &c., as in the engines of Messrs. Stephenson, Hackworth, and others, is supported by, and free to move on, an axis A, through which the steam passes, at the top of the boiler; consequently, when the engine is in motion, the cylinder will vibrate backward and forwards as the wheels revolve.

The advantages which I supposed would be gained by this mode of construction, are, a greater simplicity of form, fewer working parts, and therefore less friction, and also the facility afforded for the use of a *longer crank*, which I purpose examining in detail at some future opportunity.

Brother Jonathan having so completely got the start of me upon this occasion, it only remained for me to throw out my own contrivance, as a *hint* to guide practical men to *my* application of an arrangement which has been, for another purpose, so successfully adopted in the United States; having done this, I now take leave of my bantling, and remain, Sir, yours respectfully,

WILLIAM BADDELEY.

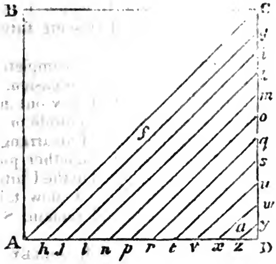
London, March 26, 1831.

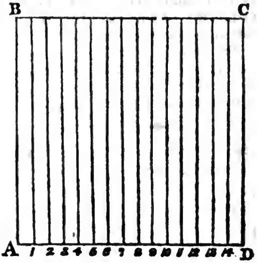
ARE RAILWAYS A NUISANCE?

At the present York Assizes an indictment for nuisance was brought on for trial, at the instance of certain Magistrates of the county, against the Proprietors of the Stockton and Darlington Railway. The Railway runs for nearly two miles alongside of the turnpike-road, and the nuisance complained of is, that the locomotive-engines frighten horses travelling the road, causing them to plunge, turn back, run away, &c. Mr. Justice Littledale said, that the case resolved itself into a mere point of law, as to what the powers are which the Railway Company possess in virtue of their Act of Parliament. Mr. Pollock, for the Company, admitted that they could not justify except under the Act of Parliament. It was finally agreed that the Jury should find that the matters complained of constituted a nuisance, unless authorized by the Act of Parliament. And it now remains for the Judges of the King's Bench to determine what extent of construction is to be given to the statute.

COMPARATIVE ECONOMY OF PLANTING IN HORIZONTAL AND DIAGONAL LINES.

Sir,—If the following observations be at all worthy of a place in your valuable journal, they may perhaps be interesting to some one of your readers. Having a small garden, which it is an object with me to make the most of, and being about to sow some seeds in a number of parallel horizontal lines, it struck me that I had sometimes seen them sown in diagonal lines, and I supposed the reason to be that a greater space was gained. In order to try this, I conceived two given equal squares, one containing horizontal lines and the other diagonal lines, parallel to and at a given distance from each other.





Supposing the sides of each of the given squares to be 5 feet, and the parallel lines in both cases 4 inches distant from each other, the number of horizontal lines included within the square will be 14, each 5 feet long = 70 feet.

It now remains to discover the length of each or all the parallel diagonals, and in order to know this, the line AC in the above figure must first be found. If in the given square a straight line be drawn from A to C, ABCD will be divided into two triangles, two sides of which are known to be 5 feet, and the hypothenuse common to both, of which the one ACD will be sufficient to ascertain the result from. As the sum of the square of the two sides are together equal to the square of the hypothenuse, in this case the square of the hypothenuse will be $\overline{5 \times 5} + \overline{5 \times 5} = 50$, and the length of the hypothenuse will be $\sqrt{50} = 7{\cdot}0710677$ feet. Half the hypothenuse therefore $= 3{\cdot}5355338$ feet, or the line *e*D is to be divided by a certain number of parallel lines, each 4 inches distant, whence $\frac{42{\cdot}4264056}{4} = 10{\cdot}6066014$ for the number of diagonals contained in half the square, supposing the first line to commence 4 inches from either extreme. But as both the extremes are to be taken in to form the series, unity must be added to represent the other extreme, and 11·6066014 will be the number of lines by which *e*D will be intersected; that is to say, that there will be 11 lines, each 4 inches apart, and ·6066014 fractional part of 4 inches to the point D; or the point D will be 2·4264056 inches from the last of the 11 lines. From the nature of the figure, all these lines will form a series in arithmetical proportion, of which the first *yz* is unknown, and the last *az* is known = 7·0710677 feet. It will be seen, from the subsequent reasoning, that the line *a*D is equal to the line *az*; and as it appears above that *a*D is equal to 24264056 inches, twice this sum, or 4·8528112 inches, or the ·4044 part of a foot will be the length of the first term *yz*. The expression to find the length of this series (by theorem 4, p. 72, Simpson's Algebra) is the sum of the first and last terms multiplied by the number of terms, or $\overline{7{\cdot}0710677 + {\cdot}4044} \times 5{\cdot}5 = 41{\cdot}11507$ feet for the total length of the diagonals contained in the triangle, which composes one-half of the square. As the hypothenuse of the two triangles is common to both the whole length contained in the square will be this sum doubled minus the hypothenuse, or $82{\cdot}230241 - 7{\cdot}07106 = 75{\cdot}15918$.

Result.

	Feet.
A square of 5 feet divided into diagonal lines, each 4 inches apart, gives a total length of..........................	75·15918
Do. divided into horizontal lines, each 4 inches apart, 14 in number, 5 feet long	70·

Whence it appears that the result in favour of diagonal lines will be 5 feet in length gained in each square of 5 feet. Supposing that one of the outside boundary lines be taken, in the latter the result would be nearly equal, but this would be to destroy the conditions of the problem.

The length of each individual line may be proved in another way. Supposing in the above figure the lines AD, D*e*, known each = 5 feet, then a line drawn from B to D will bisect the right angle ADC into two equal parts, therefore the angle *e*DA is an acute angle of 90 degrees, and since the line CA likewise bisects the right angle DAB into two equal parts, the angle *e*AD must be an acute angle of 90 degrees.

By corollary to problem 26, book i. Euclid, "if two angles of a triangle be equal, the sides opposite to them are equal;" therefore, since the angle *e*DA and *e*AD are found equal to each other, the lines *e*A and *e*D must be equal; and since *e*A is known as half the hypothenuse $AC = \frac{7\cdot07106}{2}$, *e*D is likewise found to be equal to 3·5355338 feet, or 42·4264 inches.

Now, to find the length of the next line to the hypothenuse *gh*. By corollary to problem 28, book i. Euclid, "a straight line, which is perpendicular to one of two parallel lines, is also perpendicular to the other;" therefore, since *e*D is perpendicular to AC. *f*D must also be perpendicular to *gh*, consequently the angle *hf*D must be a right angle. It has been before proved that the angle AD*e* is an acute angle of 90 degrees, whence it follows that as the three angles of a triangle are together equal to two right angles, the remaining angle *fh*D must likewise be an acute angle of 90 degrees, and, as before, since the two angles *f*D*h* and *fh*D are found to be equal, the sides *f*D and *fh* must be equal also. The side *f*D is found by deducting 4 inches from *e*D or

Inches.
42·4264 − 4 = 38·4264, the side *fh* being the same, the line *gh* is twice this sum, or 6·4044 feet. By proceeding in this train of reasoning, all the given diagonals will be found as follows:—

AC = 7·07106
g h = 6·4044
i j = 5·73773
k l = 5·07106
m n = 4·4044
o p = 3·73773
q r = 3·07106
s t = 2·4044
u v = 1·73773
w x = 1·07106
y z = ·4044

Total amount of all the lines in one triangle corresponding with the result already given. } 41·11503 feet.

Had the greatest diagonal been a whole number, the result would have been much more easily discovered, and might perhaps render the whole plainer; but in almost every case of this kind the sides would not be whole numbers, and the difficulty would still remain. Thus, supposing the greatest diagonal to be 10 feet, and the distance 4 inches, as before, the preceding reasoning will give the expression, $\overline{0 + 10} \times 8 = 80$ feet agreeing with the total of 16 lines, each 8 inches shorter than the preceding.

Though these observations may not seem to be of much importance, yet on a larger scale, such as sowing a field, &c., the difference might be worth taking into account; and if the conclusion be not correct, I shall be happy to hear a more just one from some of your numerous readers.—Yours, &c.

S. B.

London, March 19, 1831.

◆

REFLECTING LIGHT-HOUSES—MR. EZEKIEL WALKER.

Sir,—Having seen in your valuable journal an account of several methods of constructing light-houses by a combination of reflectors, but as no account is there given of the first light-house that was erected on that principle in England, the following extracts, taken from different publications, may not be unacceptable to some of your philosophical readers.—Yours, &c.

NAUTICUS.

Hunstanton, March 25, 1831.

Extract from the History of Lynn, by W. Richards, M. A. vol. i. p. 208.

"To the west of Brancaster, and not far off, is the village of Hunstanton on Hunston, as it is commonly called; near to which, on a cliff, overlooking Lynn Roads and the entrance into Lynn Haven, and elevated 90 feet above high-water mark, stands the Hunston Light-House, which is upon a different construction from other English light-houses, and supposed superior to any of them. It is lighted by lamps and reflectors, instead of coals, on a much improved and very judicious plan, the merit of which is due to Mr. Walker, of Lynn, by whom it was invented, and under whose direction it was here erected in 1778. The light is communicated by 18 concave reflectors, each of 18 inches diameter. They are fixed upon two shelves, one placed over the other in such a manner that the strongest light may be seen where it is most wanted.

"In the N. by E. direction, a strong light is necessary for ships to avoid the sands and shoals on the Lincolnshire coast: here, therefore, are placed seven reflectors in the space of two points of the compass, which will appear at some distance as one light. In other directions a weaker light is sufficient. A single reflector with a lamp of 10 single threads of cotton placed in the focus of the curve, which is a parabola, will appear, at 15 miles distance, larger than a star of the first magnitude; that is, if the glass be kept clean and the lamp trimmed.

"This house remained many years the only one of the kind in the united kingdom, but about the year 1787 several others on the same plan were erected on the coast of Scotland, as appears by the following extracts from one of the provincial papers of that time:—

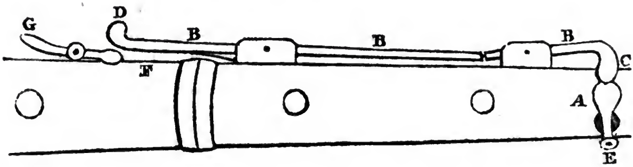
" *Northern Light-Houses.*

"An Act of Parliament was obtained a few years ago, by some gentlemen in Edinburgh, empowering them to erect four light-houses on the northern parts of Great Britain; in consequence of which, the trustees made diligent inquiry into the several modes of erecting lights for the use of mariners at sea. These inquiries were made not only in this kingdom, but in foreign parts, that their intended erections might be made on the best principles. In September, 1786, the then Lord Provost of Edinburgh applied to Mr. Ezekiel Walker, of Lynn, in Norfolk, for his opinion in the construction of them. Mr. Walker's answer to his Lordship's inquiry, and the plan projected in it gave such general satisfaction to the trustees, that they unanimously resolved on constructing and lighting them on his principle; and in the spring of 1787, the work was begun accordingly. The first of these lights stands on Kinnard's Head, in the county of Aberdeen; the second on North Ronaldshaw, the northernmost of the Orkney Islands; the third on the point of Scalpa, in the Isle of Herris; and the fourth on the Mull of Cantire, which may be seen in Ireland."—*Cumberland Packet of Sept.* 10, 1788.

Light-Houses on the Coast of Scotland.

"It has been asserted, and particularly stated in the Supplement to the 3rd edition of the Encyclopedia Britannica, that Mr. Smith, of Edinburgh, the principal, and we believe the sole contractor for managing and keeping in repair the light-houses round the coast of Scotland, is the first who conceived the idea of illuminating light-houses by means of lamps and reflectors. We do not understand that Mr. Smith himself ever claimed the merit of this invention; but it appears that reflectors such as are described above, were invented by Mr. Ezekiel Walker, of Lynn Regis, who says, in a letter dated October, 1801, and addressed to the Editor of the Monthly Magazine, (vol. xii. p. 402) that such reflectors were made and fixed up under his direction, in a light-house on the coast of Norfolk, in the year 1779; and adds further, that in the year 1787, at the request of the trustees appointed by Act of Parliament for erecting four light-houses on the northern coast of Great Britain, he instructed Mr. Smith in this method of constructing light-houses. Mr. Walker's statement of the fact is confirmed by a letter from Mr. Grieve, then Lord Provost of Edinburgh, who informs Mr. Walker that the trustees had agreed to pay the premium required for communicating the invention, and that Mr. Smith was engaged to go to Lynn Regis to receive instructions from Mr. Walker in the method of constructing the new reflectors."—*Encyc. Brit.* 4th ed. vol. xvii. p. 671.

IMPROVED KEY-FLUTE.



Sir,—Many flute-players object to the long F natural key, as tending to injure the tone, and Mr. Nicholson, in his "preceptive lessons," says, "I am of opinion that the more perforations there are in a flute, the more imperfect is the instrument." In particular passages, however, the long F natural key is very useful. Having a seven-keyed flute, and wishing for the additional long F, but afraid of injuring the tone by having it added, it occurred to me, that a key, similar to the low C keys, might be put to act upon the original F natural key. This (being a bit of mechanic) I attempted, and have succeeded completely to my wish. I am not aware that flutes have ever been made after this plan: if it is new, and worthy a place in the Mechanics' Magazine, I shall be obliged by its being inserted.—Yours, &c.

Δ.

Feb. 22, 1831.

Description.

A. The original F natural key.

B. The new long F natural key, with a double action, the part C being just over the end of A, but not actually touching it; C is also curved similarly to A, and being polished on the under side, slides smoothly upon and presses down the extremity of A, when the little finger of the left hand is pressed on D, thus opening the hole E.

F. A spring, keeping the long key in its proper position when the short key is used.

G. The G sharp key.

◆

NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

Manufacture of Sugar, *A. Garnett, Esq., of Demerara.*—The lifting and replacing of the heavy cover of the concentrating pan is, as commonly managed, a difficult and tedious operation. Mr. Garnett, by suspending it from a chain which passes over a pulley and drum, makes it the work of two or three minutes, and thus saves at once, time, labour, and fuel.—*Date of Pat. July* 24, 1830; *of Spec. Jan.* 24, 1831.

Improved Candles, *William Palmer, Wilson-street, Finsbury.* The wick is to consist of two parts, twisted spirally together, and a portion of the strands (the patentee recommends one-tenth) are to be impregnated with bismuth in a finely-divided state. The patentee states, that candles with wicks of this description never require snuffing.—*Date of Pat. Aug.* 15, 1830; *of Spec. Feb.* 10, 1831.

Improvement in Saddles and Girths, *J. Lawrence, of Birmingham, and W. Rudder, of Edge, Gloucestershire.*—The girth straps are connected to a series of grasshopper springs, by which means the girth expands or contracts as occasion requires, and is never either too tight or too loose. A very convenient description of pocket-books have been long made on the same principle.—*Date of Pat. Aug.* 10, 1830; *of Spec. Feb.* 10, 1831.

Woollen Cloth Dressing Machinery, *Daniel Papps, Stanley End, Gloucestershire.*—An improvement in the mode of applying the teazles, by which a greater diversity of action is obtained, and the pile is more thoroughly and evenly raised. — *Date of Pat. Dec.* 23, 1830; *of Spec. Feb.* 23, 1831.

Protecting Chain Cables, Iron Boilers, and Iron Tanks from Corrosion, *J. Revere, of Weybridge.*—Apply to the cable, &c., a piece of zinc, as directed by Sir Humphrey Davy, for which, and other forgotten-to-be-patented discoveries of that obscure philosopher, see Mechanics' Magazine, No. 397, 398, and 399.—*Date of Pat. Nov.* 27, 1830; *of Spec. Jan.* 26, 1831.

(To be continued.)

◆

AN ACCOUNT OF SOME REMARKABLE ELECTRICAL PHENOMENA SEEN IN THE MEDITERRANEAN, WITH SOME PHYSIOLOGICAL DEDUCTIONS. BY COLONEL F. MACERONE.

Sir,—On the 10th of June, 1830, being on board ship in the Mediterranean, Algiers bearing S.S.W. distant about 50 miles, black heavy clouds appearing just above the horizon in every quarter, except the east, and a very slight breeze from the north-west; at about 10 o'clock at night we perceived a continuation of vivid flashes proceeding from below the horizon, just in the direction of Algiers. For the space of half an hour we attributed the appearance to the firing of artillery and the explosion of shells; but upon the gradual arising of the bank of cloud, we perceived that it was lightning. The clouds continued to rise, and the lightning to spread to the northward of west. The weather continued calm, and beautifully clear over head and to the eastward. The sea-water was more than usually luminous, or, as it is called, phosphorescent. At about 10 P. M. the nearest edge of the arising bank of clouds was S.S.W. of the ship, at an angle of about 35 degrees. Vivid zigzag streams of electricity passed to and fro along the mass of clouds; and some occasionally fell vertically into the sea, at about a mile from the ship.* Whilst we were admiring the beautiful effect of the electrical function performing in the atmosphere, our attention was suddenly and most intensely excited by a phenomenon which no one of us had ever before witnessed, or even heard of. At less than 50 yards from the ship's larboard bow, that is, towards the S.S.W. the most vivid lightning was flashing *under water*. The actual electric streams or zigzags were not observable, being perhaps at a considerable depth. The flashes or illuminations appeared to be circumscribed to an extent of about an acre, and were similar to what would be produced by the explosion of large parcels of gunpowder at the bottom of the water, repeated almost every second, and sometimes with the rapid quivering repetition attending atmospheric electrical discharges. The phenomenon continued for several minutes, without a single flash of lightning proceeding from the clouds the nearest to the ship, that is, the bank which was gradually arising from the S. W. which now formed with the ship an angle of about 45 degrees. The submarine electrical field now appeared to be receding from the ship, and approached towards the mass of clouds in the S. W.; and its movement seemed most rapid as its distance from the clouds diminished. But as soon as this electric subaqueous accumulation appeared to be perpendicularly under the cloud, a magnificent discharge took place. A column of electric fluid, which spread around the light of day, flew *up* from the sea, and dividing itself into many zigzag branches, entered the clouds above, which shortly after sent out several discharges in various directions. Rain now began to fall. The hitherto calm surface of the sea became ruffled by contending breezes from each point of the compass,—the clouds closed in on every side, but on the morrow not a vestige of them was to be seen.

What surprised me greatly in the above-sketched phenomenon was the repeated and continuous flashes *under water* for so long a period, *without* any discharge upwards into the clouds. As to the fact of the electric discharge proceeding from the sea, or the earth *upwards* into the overhanging thunder-clouds, it was by no means new to me. In 1811, being at Ostia, at the mouth of the river Tiber, I witnessed a most beautiful instance of this reversal of the more ordinary electric projections. During a nocturnal thunder-storm, in the month of November, I observed a column of electricity,* apparently as thick as the mast of a ship, ascend from the sea, and separating suddenly into innumerable zigzag branches, as from the trunk of a tree, disappear in the overhanging clouds. I have on two other occasions seen similar electrical actions in the bay of Naples, but I never, before the case above described, either saw or heard of such an electrical developement being stationary, as it were, and flashing under water, for several minutes.

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* I call the visible electric discharges zigzag "*streams*," because such is their appearance to the eye; but I suspect that such discharges are in huge sparks or balls, the rapid motion of which gives them the appearance of *streams* or continuous lines, just as we may form circles or other figures in the dark with a lighted stick.

* See preceding note on the word "*stream*" of electricity.

It is a question of some interest, how far our ship may have been endangered by the subaqueous discharges I am speaking of. The query occurred to me at the time; but it also struck me, that the vessel not being coppered, but only covered with a thick coat of pitch and sulphur, (non-conducting substances) its bottom might perhaps repel, instead of attract, the electric fluid. Whether ships have ever been injured or destroyed by *ascending* electrical discharges, I have never heard. At Lausanne, I was informed of a well-authenticated case which occurred in that neighbourhood, of an electrical discharge *arising* from the earth, under a cart in which were two men, one of whom was killed, together with the shaft-horse. The cart was shattered to pieces, particularly one of the wheels, under the site of which the *ascending* discharge left a hole six inches diameter.

In volcanic eruptions, electric discharges are frequently seen to issue from the upper part of the column of gas, fire, and smoke, which arises from the crater, but I have not seen it any where recorded, that similar discharges *ascend* also from the cones and craters, into the cloud of ashes and smoke above them, During an eruption of Vesuvius in 1810, my progress was arrested when about half way up the cone, by innumerable discharges of lightning. Subsequently to my setting out on my way up the mountain, the eruption had rapidly increased in violence, and the lava had not yet began to flow. By the time I arrived at the foot of the cone, the column of fire proceeding from the centre of the crater, surmounted by an enormous mass of jet black cloud of smoke and ashes arose to the height of 9,000 feet above the top of it. Electric zigzags occasionally issued from this mass, but by the time I had got half way up the cone these discharges had become incessant and innumerable. Volleys of zigzags issuing from the column and its surmounting cloud, fell into the crater, or on the exterior margin of it, with such force as to make the stones and cinders fly about, as though struck by cannon shot. An equal number of discharges proceeded *upwards* from the crater into the cloud above; and many zigzags, after taking an indeterminate course midway between the crater and the cloud, would return into the column from whence they came. Each of these innumerable electric discharges was accompanied by a sound similar to that of a musket, so that the whole produced the effect of a rolling fire of infantry. The violence of these operations increasing, and several zigzags as well as masses of lava from the column, striking the cone very near to where I stood, compelled me to descend. The pieces of lava now began to fall on the upper part of the cone in showers of countless numbers, and rolling and bounding downwards with almost the velocity of cannon shot, one of the asses of a party of visitors that were approaching the base of the cone, was killed by one of these red hot projectiles, half a mile below me. But you will, perhaps, accuse me of wandering from my subject of submarine *ascending* lightning, in thus alluding to one of my forty-two visits to Vesuvius; especially, as such "*personal narratives*" when unaccompanied by rational generalizing deductions from chemical and geological *facts*, convey no useful instruction whatever. Sir William Hamilton, and several other respectable old ladies amongst the F. R. S. have published voluminous accounts of the direction which the lava took at one hour; the direction that it took at another; how it hissed, and smoked, and crackled; how it rushed in, and how it rushed out; and how the stones fell around and about: without once thinking or telling us any thing of the chemistry, or rather *physiology*, of the matter, or appearing to dream that the electrical decomposing and secreting operation they are describing, is as inherent and necessary to the developement, growth, constitution, and vital career of the identity we call "our" globe, as are the decompositions, secretions, inspissations, and indurations, which constitute the existence of other forms of matter, vainly attempted to be separated from the great Pan or *whole*, by the appellation of "organic."

With respect to the volcanic phenomena, which I take to be part and parcel of the *physiology*, or *comparative anatomy*, as it were, of "our" globe, I must say that I have never seen it rationally treated upon. During a ten years residence at Naples, I put together a good many observations on the subject, but I had the chagrin of losing my manuscripts at sea. I will, however, on a future day, attempt to give you a brief sketch of my ideas on the subject, if you think them worthy of a place in your valuable Magazine. In the mean while, I will take the liberty of propounding a few thoughts connected with my views of electricity for the cogitation of your readers, being persuaded that, to generalize facts and to deduce from them general conclusions, by dint of habitual observation and comparison, is the most successful of all modes of study. As yet, there are but few books which do not contain much matter, intended to deceive the readers. The arts and sciences are all made to minister to the cause of falsehood and extortion! Some writers may be dupes, but the greater part are dupers. All tack to their *facts* fanciful assumptions and fraudulent conclusions. And this for the *useful* purpose of making the operations of nature tally with their peculiar systems. But to my queries.

Is there no analogy between the alternating layers or strata of air, clouds, water, earths, wet and dry (proved to be metallic oxides) which constitute the atmosphere, and the outer or known portion of "our" globe, and the alternating layers which form the Voltaic battery?

Is there no analogy between this alternating stratification of our earth and the structures of "organized" identities, with their skins, cellular membranes, muscles covered by aponeuroses, continually rubbing against each other; fat, internal membranes, with intervening fluids always in motion?

Are not brains, nervous ganglions, and nerves, which are evidently the seats and conductors of vital action, in the identities we call animal, real electrical machines; similar in principle, as they are similar in substance and in structure, to the electrical discharging-apparatus of the gymnotus and torpedo, which consist of large brain-like ganglions connected with the spinal cord?*

Are not the whole of what we call the "vital" phenomena, produced by certain modifications of the electric galvanic magnetic matter and motions, and do we not find that these vital phenomena are continuously affected by the relative state of the surrounding electric medium? We find that the arrangements, decompositions, and transformations, we call chemical, and chrystalizations are influenced and variously modified by the electric, magnetic, and galvanic action; which latter *modus*, in particular, has been found to operate with unequalled "decomposing" powers.

Are not heat, light, electricity, the galvanic and magnetic fluids, one and the same substance?

Is not this the great ubiquious substance of substances, which fills all space, and through which *every thing that* is—suns, planets, satellites, are connected together—fixed in their stations, and form a whole?†

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* If we place the finger and thumb in the internal canthus of each eye, and, by expanding them, compress the eyeballs, brilliant circles of real light will be produced within the eyes. It is well known that the eyes of many animals are luminous and visible in the dark.

† As it is quite above my comprehension how attraction and repulsion can *proceed from the same point and act on the same line, in opposite directions at the same time,* I am obliged to look for some other power to keep the planets, suns, and stars, in their places. This, I conceive, is effected by the expansive emanations, inseparably and continuously proceeding from all and every one of those bodies, the compressible operation of which, acting upon each body in every possible direction, of necessity confines them to the stations which have been assumed in virtue of their respective masses and densities. This matter, thus universally emitted and received back again, is light.

The universal action of expansion will also account for the tendency which all matter evinces when at liberty, *i. e.* in a fluid state, to assume a globular shape. The expansion of certain bodies pressing one against the other, as the cells of a honeycomb, the bubbles in a half empty porter-bottle, or the crystalline arrangement of incandescent masses of basaltic lava, produces figures consequent to the directions of the mutual compressions caused by the simultaneous expansions—thus forming hexagons, dodecahedrons, hexagonical prisms, &c. But the forms which a drop of water, a sun, a particle of mercury, a planet, or a soap-bubble, acquire, are spherical through the equal universal expansive pressure by which they are surrounded. Globes in a high state of radiating expansion spontaneously revolve upon their axes. A globule of silver in fusion, at a great heat, turns round with great rapidity at the bottom of the crucible.

I have often watched the large drops of rain falling on the smooth surface of the water, retain their globular identity for several seconds, while they revolve rapidly in their axes. When the rotation ceases, they disappear.

Is it not likely (speaking of details) that carbon is the produce of the absorption and concretion of the sun's rays or light, by vegetable structures; and that the diamond is produced by an analogous absorption, or rather chrystallization of light, in certain soils and situations, subjected to a particular state of electric action? Are not sulphur, phosphorous, and some other substances, mere concretions or oxidations of electricity or light? And are not all substances resolvable into light, of which they give out such prodigious quantities in the process of combustion?

Is not this electric fluid or light, the great cause and substance of action, aggregation, and decomposition, *in secula seculorum*, of every thing *which is*, with which we are acquainted; and, is not our sun the great dispenser of this daily bread to our globe, and all her sister planets?

In fine, is not—but I must be content for the present with the questions I have already propounded, and I should think myself very happy if any contemplative correspondent of yours, and who takes *facts* only for his guides, would condescend to give an opinion upon any of the points alluded to.

(To be concluded in our next.)

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MISCELLANEOUS.

Papin's Perpetual Motion.—The celebrated Papin used to exhibit on his chimney-shelf an ever-flowing fountain, and to challenge visitors to show how it was produced. He even went the length of publishing a description of this mysterious ornament, and some persons were simple enough to suppose that the long-sought-for perpetual motion had been discovered. Papin at last disclosed—what it is probable most men of science had all along guessed to be the case—that the effect was produced by concealing within the shelf a pipe through which air was forced from an adjoining room into the apparatus.

Division of Labour is not always the characteristic of an advanced state of society. In Normandy, at the present day, three persons are invariably employed in the operation of shoeing horses; one man seizes the horse by the head, another takes hold of his foot, lays on the shoe, and holds it with both hands; while the third strikes in the nails!

Effect of Hydrogen Gas on the Voice.—Maunoir was one day amusing himself with Paul, at Geneva, in breathing pure hydrogen gas. He inspired it with ease, and did not perceive that it had any sensible effect on him, either on entering or passing out of his lungs; but after he had taken in a very large dose, he was desirous of speaking, and was astonished at the sound of his voice which was become so soft, shrill, and squeaking, as to alarm him. Paul made the same experiment on himself, and the same effect was produced.—*Prevost.*

Ductility of Silver.—A single grain of silver may be expanded into a hemispherical vessel, capable of containing four hundred and eighty times its weight of water.

Varieties of Gold.—Goldsmiths usually indicate the purity of the gold they sell, in the following manner. Perfectly pure gold, they suppose divided into 24 parts, called carats. Gold of 24 carats therefore means pure gold; gold of 23 carats, means an alloy of 23 parts gold, and one of some other metal; and so on. The number of carats mentioned, indicates the pure gold, and what that number wants of 24, indicates the quantity of alloy.

New Metal.—Berzelius has published an account of a new metal discovered by his friend Seftstrom, in the mine of Taberg, in Smöland, and proposed to be called Vanadium, after the Scandinavian deity, Vanadio. It forms a reddish salt, which has the singular property of becoming perfectly colourless when dissolved in water.

Locomotive-Carriages.—On Saturday last, Mr. Stephenson's engine, the *Samson*, carried at one trip 549 bags of cotton, estimated to weigh 109 tons, 16 cwt. from Liverpool to Manchester, in three hours and a half, being assisted up the inclined plane by the *Goliah*, another engine of the same powerful description.

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NATIONAL REPOSITORY, for the Annual Exhibition of New and Improved Productions of the Manufacturers of the United Kingdom, in the Gallery of the Royal Mews, Charing-cross.

Patron—The KING.

Artists, Manufacturers, Patentees, Modellers, Mechanical Draughtsmen, &c. &c., are requested to notice that the arrangements now in progress for the immediate opening of the Fourth Annual Exhibition to the Public, renders it highly important that the Specimens intended for Exhibition this present Season should be sent to the Repository without delay.

In consequence of the grant made by his Majesty's Government of the use of this Public Building for the purpose of promoting and encouraging New Inventions and Improvements in the Arts, Sciences, and Manufactures of this country, no fees or charges of any kind are made for the Exhibition of any New Invention or Improved Production in the National Repository.

T. S. TULL, Secretary.

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INTERIM NOTICES.

F. R. H. of 12, Goodge-street, Tottenham-court-road, states, that he will divulge (on conditions) the process of making concentrated sulphuric acid, respecting which there was an inquiry in our 398th Number.

E. H. of 42, Warren-street, informs us, that he has contrived "an improvement in the working of pumps, by which one man may do the work of three:" but that the invention remains dormant for want of the means to take out a patent.

Communications received from Mr. Shires—L. G.—B.—Mr. Fowler—Mr. Baddeley—Hidalgo—An Amateur—Dr. Prentice—Nequam.—Ed. Vocis Rationis.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

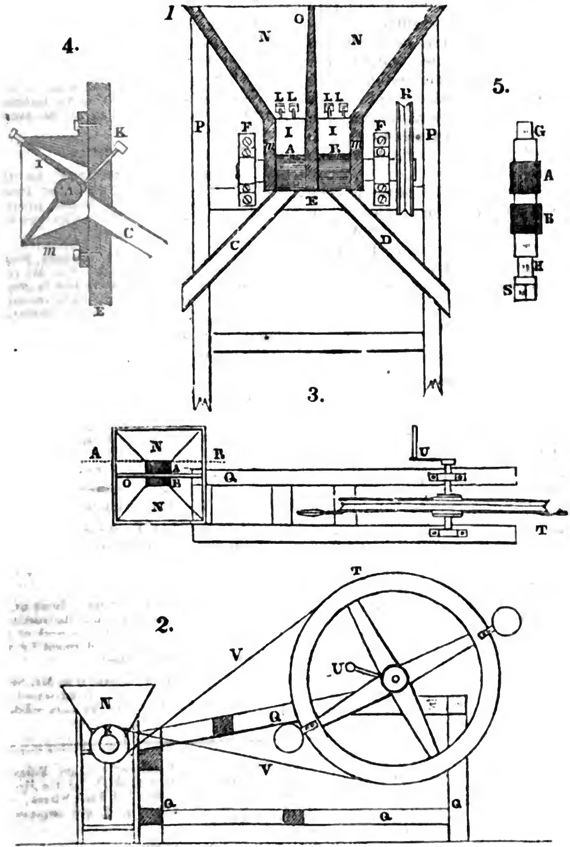
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 401.] SATURDAY, APRIL 16, 1831. [Price 3*d*.

PORTABLE HAND-MILL.



PORTABLE HAND-MILL.

The engravings on the preceding page represent a portable hand-mill, invented by F. M. Jacquemin, a mechanician of Guebuiller, in the department of the Haut-Rhin, and stated in the *Recueil Industriel,* from which we extract this account, to be capable of grinding thirty kilogrammes (64lbs. 4 oz. Eng. avoird.) per hour.

Fig. 1 is a vertical section of the front of the mill; figs. 2 and 3 a side elevation and plan of the mill and framework (Q); fig. 4 a vertical section drawn sidewise through the dotted line AB, fig. 3. AB are two grooved cylinders, which turn on the same axis, as shown in fig. 5. The cylinder A, which is called the finisher, is employed to convert corn into flour. The other, B, which is styled the grinder (*grugeoir*) and has larger grooves, is used to grind barley for the malt-house or stable; it may also be applied to the crushing of oats. C, figs. 1 and 4, is a tin pipe for the discharge of the flour from the cylinder A. D, fig. 1, is a similar discharge-pipe adapted to the cylinder B. E is a wooden platform on which the mill is mounted. F are two sockets or bushes fixed in the platform, which receive the pivots GH, fig. 5, of the axis of the cylinders AB. I, figs. 1 and 4, are two curved plates, with grooves underneath, which work into the cylinders AB, when brought together by means of the screw-nut K, fig. 4; the height of each of them is determined at pleasure by the two regulating screws L, figs. 3 and 4. M is a box for holding the grain; it is attached to the platform E by screws, as shown in fig. 4. N, figs. 1, 2, and 3, is a hopper, divided into two parts by the partition O; one division receiving the corn destined for the cylinder A, and the other the barley, &c. for the cylinder B. P is the house for holding the mill. R, figs. 1 and 2, is a grooved pulley mounted on a block, S, fig. 5, affixed to one of the extremities of the axis of the cylinders AB. T is a larger grooved pulley, furnished with two lentils, which give it the property of a fly; the axis of this pulley has a crank U, with which motion is given by hand to the pulley T. V is a cord which passes over the pulleys R and T, and communicates the motion of the prime mover to the axis of the cylinders A and B.

ACCOUNT OF SOME REMARKABLE ELECTRICAL PHENOMENA SEEN IN THE MEDITERRANEAN, WITH SOME PHYSIOLOGICAL DEDUCTIONS. BY COLONEL F. MACERONE.

(Concluded from our last Number.)

I have now to request the attention of your readers to a very interesting exhibition of an electric, galvanic, or vital action, which is in constant operation throughout the seas and oceans of our globe, and which I had an opportunity of observing last June in the Mediterranean.

It is disputed whether the luminous appearance of the sea be occasioned by what the disputants term "animal phosphorescence," or by electricity. I have had opportunities of paying much attention to this phenomenon, and it appears to me to be *both* electrical and animal; I mean, that the vitality and electricity, the electricity and vitality, are one and the same thing. The waters of the sea are so full of vital rudiments, as in some cases, in hot weather, to make it difficult to say whether the rudiments or the water form the greater mass, at least within a few yards from the surface. The most simple or primary of these rudiments visible to the naked eye, which I was able to discern, were extremely minute globules, so perfectly colourless and transparent, as to render them quite invisible, except in a bright sunshine. These globules have a tendency to unite one to the other, so as to form filaments equally colourless and transparent. The filaments appear to acquire a kind of polarization, one end being evidently in a different condition from the other, by which they are inclined to take a vertical position. Their number is beyond all estimation, the water being as full of them as a silver or japanned waiter is of minute scratches.* A glass goblet full of sea-water certainly contained many thousands of them, visible to the naked eye. After standing quiet for a few moments, the far greater number of the filaments floated, neither horizontally nor vertically, but at an angle of about 45 degrees, and, what much interested me, they inclined to the direction of the magnetic needle. *Fasci* of filaments were now apparent, (I thought that the water getting warmer in the glass promoted this aggregation); the *fasci* appeared to be attached together at one end like a birch rod, which end appeared to be the absorbing or positive pole; the other being probably the transferring or negative one. I am not prepared to say whether these identical rudiments made any further progress in animal organization than that above stated. Millions and continued millions of vital combinations must necessarily have proved abortive at each successive step towards the complexity of what are called the more perfect animals. During each peculiar state of this world's existence, there has been ample time for every possible change of combination to be rung through and through. Hence no new productions, save those of the most primary rudimental kind, the most simple of the gelatinous animations, infusory animalculæ, &c., are elicited, except in so gradual and imperceptible a way, as to escape the observation and the knowledge of the multitude. The acute observer of nature, however, plainly sees, that at one period, in the infancy or childhood of this world's existence, a period of many hundred ages, when it was entirely covered with water, moluscæ, testaceæ, then fish were of necessity the first and the only existing animalizations, and that of these many of the species are now become extinct. He sees the like to have happened with the monstrous extinct amphibiæ, whose existence and whose reign commenced upon the first appearance of land above the surface of the waters;* and further, that many amongst the first-formed animals, whose production was a consequence of the further exsiccation of this globe, are now no longer reproduced. Lastly, the observer of facts perceives, that man, and his next akin, the simiæ, did not exist until *comparatively modern* times.

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* If a piece of plate or japanned ware be viewed in the proper light and position, it will be found that at the point or centre of visual incidence, innumerable fine scratches become visible in concentric circles, with the point of light for a common centre. Carrying the eye over the surface, so as in succession to take any part of it for a centre, the concentric circles of scratches are equally numerous on every point. Now, if we consider how many lines there must be for these to be at every point of the surface, a sufficient number of curved ones which will form countless concentric circles of every size, from a point, to the whole extent of the surface, and all other lines save those concentric to the point of visual incidence being invisible, we shall be convinced that there must be many millions of scratches, visible to the naked eye, upon the lid of a snuff-box or the surface of a watch-case.

Whether man is the best fruit of this globe's maturity, or whether at some future period a race of still more perfect animals will grow into our places, is a question which might admit of much curious disquisition, with which I shall perhaps one day trouble you. This discussion will hinge upon the argument whether this globe is at present in its adolescence, in its maturity, or in its senescence.

But to return to my rudiments and fasci,—I must remark, that the only progress in the scale of organization was, to the best of my observation, their apparent conversion into vegetable structures of a filamentous appearance, like some of the conferva. After keeping on deck a bucket of water in which there were millions of the filamentous rudiments above described, for three or four days, the rudiments disappeared, and the sides of the bucket near the edge of the water were covered with the confervæ-like vegetation.

With regard to the luminous appearance of the sea, the rudiments I have been speaking of were highly "phosphorescent" in the dark; and it was evident, that the water contained millions of animalculæ all equally so. Besides the mass of minute rudiments and animalculæ, which communicate to the agitated water the appearance of liquid fire, there are other countless millions of primitive gelatinous formations, from the size of a pin's head to that of a man's hat, which give out light, not all in a fixed and permanent condition, but alternating with darkness, in accordance with the contracting and expanding systole and diastole, which constitute their only motions. Now, in certain states of the atmosphere, the sea is much more "phosphorescent" than at others. This is attributed to electricity, and I think with reason; because the electric currents being then passing with greater activity from the water into the atmosphere, or *vice versa*, gives increased animal, *i. e.* electric energy, to the organic rudiments and *sketches* already existing, and by polarizing other progressing molecules, increases their vital, *i. e.* electric action and "phosphorescence." But my limits are already much exceeded, and I must reserve some further reflections I should wish to make for another communication. Meanwhile I am, Sir, your obedient servant,

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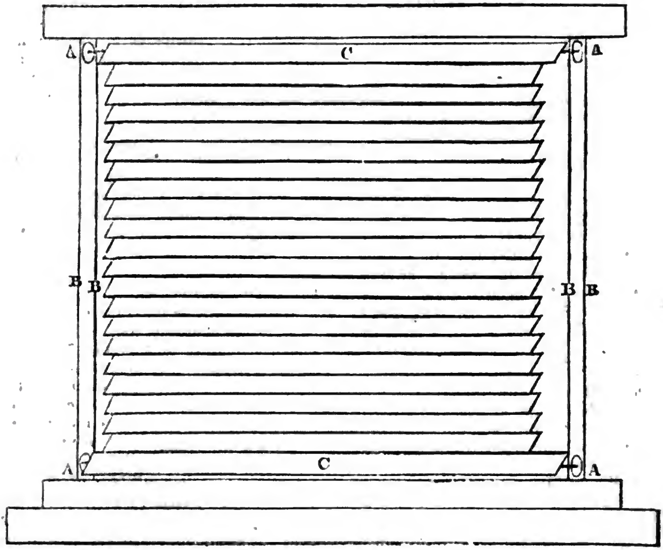
* It appears evident to me, that the water, which during one great period covered the surface of this globe far above the tops of the highest calcareous mountains, became progressively decomposed and solidified, that is, converted into earths through the action of two principal agents, volcanoes and zoophita or coraline animalculæ. A volcanic action commences at the bottom of the ocean. The produce of its laboratory is thrown up; it forms a cone, which, gradually increasing in size, at length appears above the surface, and is called an island. Clusters of such islands, all increasing, join and form a larger one, and at length a "continent." It is quite clear, that in this manner were formed the West India Islands, all the South Sea Islands, the Hebrides, the Canaries, Cape de Verds, Sicily, all central America. Several of the Lipari Islands have been produced in this way in our own days.

The accumulation of shells, especially bivalves, at the bottom of the sea is enormous, and banks of coraline, of many hundred square miles in extent, have been seen to appear at the surface, where a few years previously there were several hundred fathoms depth of water. On this subject I will send you another paper.

F. MACERONE.

IMPROVEMENT IN VENETIAN BLINDS.



Sir,—Having recently invented what has been always considered a desideratum in Venetian blinds, namely, a means of precluding the possibility of their annoying the inmates by their perpetual clattering in windy weather, I shall feel obliged if you will give it an early place in your valuable Magazine.

Yours, &c. C. B——K.

Description of the Engraving.

AAAA are pulleys, which play freely between the perpendicular rods BB. CC represent the top and bottom laths of the blinds (which ought to be made about twice the thickness of the others, and half an inch longer at each end, to prevent their striking the rods in any violent wind), at the ends of which are fixed small wires, that serve as axles for the pulleys AA. In other respects, the present blinds exactly coincide with the common Venetian blinds, namely, in pulling up and letting down; and they will be found to equal them, both in admitting and in excluding the light.

SUPPLEMENTARY REPLY OF THE ED. "VOCIS RATIONIS" TO MR. BADDELEY (ABRIDGED BY THE AUTHOR).

Sir,—Mr. Baddeley (No. 390, p. 384) observes, "the author of the Voice of Reason says, 'the syphon has only the weight of water effective that is contained in that portion of the longest leg which is above the level of supply.'" If this be true (which it is not) it was in favour of my argument against the efficiency of Mr. Linley's syphon, in which I went upon the supposition that the water or level of supply was to have been *kept up* continually to a *certain point* up to the bend of the syphon. But, moreover, I can *prove* that the water in the longest leg would *not* descend from it by its own *gravity* or *weight*, without the pressure of the air—no, not if even the pressure of the air were removed also from the orifice of the long leg of the syphon. If I can prove this, what becomes of Mr. B.'s assertion, "It therefore follows, that the atmosphere in no way assists or influences the effective action, either of the syphon or the upright column of water"?

Proof—Take a small syphon, draw it full of water in the usual way, place your finger closely over the orifice of the shorter leg, whilst under the water; the syphon will immediately stop and remain *quite full* of water, and the water will *not* fall from *the longest* leg by its *gravity;* neither can you draw it from thence by *suction*, or by introducing a *vacuum under* its orifice. In this state, the syphon may be held up in the air, and on removal of the finger from the orifice of the short leg, *all* the water in the syphon will descend by the long one.

Oh, that unfortunate pneumatic problem (No. 381, p. 231), or rather Mr. Trebor Valentine's unfortunate letter (No. 388, p. 352)! It quite put out of Mr. Baddeley's head what little knowledge he might have entertained on the subject. It appears that when Mr. Baddeley was *partially right*, he did not know it, and permitted Mr. Valentine (No. 388, p. 352)—who compared the gravitating of a *fluid*, or water *in vacuo* to that of a *solid* under an exhausted receiver! (a proof in point of "the present advanced state of mechanical knowledge!")—to pronounce him, Mr. Baddeley, in *error;* and what is still better, in proof of Mr. B.'s "advanced state in mechanical knowledge"—he inserted a very polite note (No. 390, p. 400), thanking Mr. Valentine, in handsome terms, for so doing. Mr. Baddeley *might* have *proved* Mr. Trebor Valentine in *error* by the following easy experiment:—Take a large glass bottle filled with water, insert through the cork a common goose-quill, open at both ends; let the cork be made air-tight, place the bottle on a table, and apply your lips and mouth close round and over the quill, form a vacuum in your mouth, and suck as hard as you can; if no air get into the bottle you will not be able to suck up any water; when you cannot suck up any water, it is a proof that all is air-tight. Then keeping your mouth still over the quill, sucking at the same time, raise the bottle gently over your head and suck away—in fact, you may suck, but provided no air get into the bottle—the water will not obey *gravity* nor your *suction*. Now, since Mr. Baddeley inserted so polite a note, thanking Mr. Valentine, I hope he will now discriminate who is most deserving of his thanks. The same experiment stands with any other vessel or cylinder. Mr. Baddeley will excuse my not explaining the "cause" of these paradoxical results in pneumatics, for reasons before advanced.

I beg to inform Mr. B. that the theory contained in his flourishing postscript is quite wrong, as any "old maid," who ever wrote a long P. S., could prove. As to what Mr. B. denominates "ludicrous errors," to be sure, if you look at the engraving, the engraver, as if to afford another proof of "the present advanced state of mechanical knowledge," has misplaced one of the rods over the spoke, which should have been on the opposite side. Probably Mr. B. could have pointed out this ludicrous error, which is not mine; or probably the engraver, with Mr. B., might have imagined that "the thing" was going down hill, and therefore thought it a wise precaution to chain up the wheel, lest *science*, in perpetual motion should *progress* too fast for them.

"Many of the errors (says Mr. B.) will be met by the remarks above, and *one* only shall be noticed here; 'besides, says the Ed. Vocis Rationis, water rises of itself in a vacuum, and hence it does not require much force to raise and depress a pump-handle.'" The above quotation from my letter was in reply to a Correspondent, who said, "if he had not corrected himself by sober calculations, *his head* would long ago have been a mere WHIRLIGIG." No. 382, p. 262. It was my intention to have shown Mr. Whirligig his error in reducing the *whole* machine, pump and all, to a *single* lever, because said I, "the water rises of itself in the vacuum," that is, the water would rise through *the* space of 22 or even 32 feet after the vacuum was *once* formed, and there it would remain (if the pump were good), and only required in future to be let out "as fair and softly as possible." So that all this *space* might have been *exonerated* from *the calculation* of the single lever. For when the water was once fetched, this first process would not require repetition, *i. e.* if the pump were perfect, and no longer an air-pump. Nor would any good pump-maker ever think of leaving a pump in this unfinished state. Well, this Mr. Whirligig "by *sober* calculation," having reduced the pump and *all* to a *single lever*, further said:—"One gallon of water must be raised through a space (of course solely by that lever) of 22 feet," which, I need scarcely repeat, there was no necessity for, since it *was done* by other means. Was there any necessity to state more than that the water rose in the vacuum of itself through that space, since it was not simply by *the mechanical power of the lever!* An extraordinary lever, indeed! I see Mr. Linley has fallen into the same error, by *condensing* his water-wheels. If water will rise in a vacuum to the height of 32 feet, why trouble about the "*height*" less?

"But (says Mr. Baddeley) the vacuum must be made; no such thing exists in nature. Nature, *say* the ancients, abhors a vacuum;" I know, Sir, nature abhors a vacuum—and, if Mr. B. would permit *nature* to instruct him a little, there might be none. But, Sir, to be "fair and softly," the vacuum *was* formed, and taken permanent possession of, by an upright column of water, 32 feet in altitude.

Mr. Baddeley says, "The force required to work a pump handle may be ascertained with tolerable accuracy, by multiplying the area of the piston in inches by 15, which will give the amount in pounds, of the atmospheric pressure upon the piston; and *this is the force* which has to be overcome *in depressing* a pump-handle." Now, for "a sober calculation." Suppose the diameter of the piston four inches, the weight of a gallon of water 10lbs., and the pressure of the atmosphere upon the piston 15lbs. to the square inch (the weight of lever and upright 32 feet column of water being left out of the question). Required the force of pressure upon the piston.—Ans. 198lbs., the pressure which *a man's arm* has to overcome at *every* depression of a pump-handle. Or in other words, a person weighing 24 stone 6lb. must hang with his whole weight upon the handle of a Franklin pump before he could depress it!!

But what will Mr. B. say to the following assertion? The weight of the lever being left out of the question, and the weight also of the upright column of water, 32 feet in altitude, which is *generally*, but *fallaciously*, taken into calculation, the force required to raise the handle of a good water-pump must be equivalent to the force which is required to open the valve of the moveable sucker, and to plunge it in the water which stands above the fixed sucker. The force required to depress the pump handle must be equal to the weight of the water above the moveable sucker, varying according to the velocity necessary to repel it, and the stiffness or friction of the moveable sucker. In fact, if you raise a pump handle, it will fall down by its own weight; and how could this be if it had 198 pounds on the other end of it? But it will not expel the water! No; because such *force* is not sufficient to close the valve—hence, since this force varies according to the velocity and stiffness of the sucker, it cannot "be ascertained with any tolerable accuracy."—Some pumps go stiffer than others; those that go stiff are very faulty; for, if *properly* made, there should be no necessity to exert more force than I have stated. One general fault amongst many is, that the water cannot follow the moveable sucker in a sufficient body. Its velocity is *retarded* by the smallness of the lower cylinder, to the bottom of which the water is in many cases only admitted by small holes, which are liable to stoppage. Under such circumstances, I grant the force required would be extraordinary. The above may be proved as follows. Since the air presses equally in all directions, the pressure of the air on the surface of the water in the well tending to force the water *upwards* into the cylinder, must be *equal* to the pressure of the air upon the surface of fluid above the moveable sucker, tending to force the water *downwards;* therefore, since the water on the motion of the sucker upwards would *follow* it, the pressure of the atmosphere or the intervening water upon the bottom of the moveable sucker upwards, would be equal to the pressure of the air upon the water above its upper surface downwards, so that these equal forces in *opposite* directions must keep each other at rest—consequently, the *remaining force* to be overcome would be as I have before stated.*

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* For want of "space" I have not supported this by further proof, which I am prepared to do if *disputed.* It is *erroneous* to suppose that the 32-feet upright column of water presses with all its *weight* upon the water in the well, or that it is balanced or *supported* by it, and *kept in the tube* by the equal pressure of air on its surface; for supposing the vacuum of the cylinder perfect or air-tight at top, the cylinder might be raised from the surface of the fluid in the well, and its contents, viz. 32-feet column of water would *not quit it*—∴ it is *not* sup-

In conclusion, I hope Mr. B. will, in future, be more *courteous* to science—*encourage* her, promote her, study her, not "*scratch*" her.

I suppose Mr. B will have the curiosity to ascertain how the Age of Reason fares (as far as *the defence* of Christian faith is concerned) when *pitted* against the *Voice of Reason*. I would recommend him to peruse attentively the *latter*, and to hearken to THE VOICE, and for this further reason, that, however *forward* he may be "in the present advanced state of mechanical knowledge," he may not be *backward* in that of Christian.—Yours, &c.

ED. VOCIS RATIONIS.

April 6th, 1831.

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STATISTICAL PUZZLE.

"There is a country where the land is always ploughed, but seed never sown, and which yet yields abundant crops year after year, without intermission. Where is this country, and of what kind are the crops?"—See Mech. Mag. vol. xiii. p. 96.

Answer by Hidalgo.

In the eastern and southern parts of Spain, great part of the land, and even the very dust on the roads, are richly impregnated with natural saltpetre, which is collected in the following manner:—The ground near the villages is ploughed two or three times in winter and in spring. In August, the earth is thrown into ranges of vessels of a conical shape, perforated at the bottom, and filled, to the height of 10 or 12 inches, with matweed and ashes. Water is then poured on, and allowed to filter through. The lye that results from this operation is put into a boiler. The common salt, which precipitates and crystallizes when warm, falls to the bottom in the proportion of 40 per cent.; the liquor is then poured into buckets, placed in the shade, where it shoots and crystallizes into saltpetre. The same earth, deprived of its nitrous quality by this process, is again carried back to the fields and exposed to the elements; by which means, in the course of twelve months, assisted by the all-powerful and invisible hand of Nature, it again becomes impregnated with a fresh supply of nitre. The same lands have produced from time immemorial an equal quantity of saltpetre; so that were there to be no longer any artificial saltpetre manufactured in France, Germany, and other countries, Spain alone could supply all the rest of the world with saltpetre without the aid of either a fixed alkali, ashes, or vegetables. A cultivator of these nitre-fields was once asked the reason of this constant reproduction, but the only answer he could give was, "I have two fields; I sow one with corn, and have a crop; I plough the other, and sow nothing, but have a crop from it also."

Answer by Echo.

In the West India Islands the land is ploughed for the purpose of planting the sugar-canes, but no seed is sown.

[Both answers may be said to satisfy the conditions of the question; but the first we apprehend is the more correct one.—EDIT.]

◆

COL. WALKER'S FIRE ESCAPE—SEE MECH. MAG. NO. 399, P. 78.)

Sir,—This invention, though so simple in its application, I consider to include in its principle some curious and interesting particulars.

Suppose the counterpoise to be so regulated as to be equal to one half of the person descending or ascending, and that the person ascending by clinging to the rope, exerts a force or tension on the rope, equal to one half his weight, renewing his hold by each succeeding knot, does he not in effect constitute himself a moveable pulley with his own weight attached, and convert the tackling into that of three lines of tension and support, or a system of pulleys consisting of one fixed and one moveable one, in which system the weight and power are as 2 to 1? Now, in a tackling of this kind, the equilibrium being destroyed by a small addition of power, the power has to descend through twice the space the weight ascends, but not so in the present case, as the descent of the counterpoise, and ascent of the weight are still equal in distance.

I am aware this may be thought namby-pamby by some of your readers; still it is a circumstance worthy of reflection, and may in its consideration lead to knowledge worth the seeking.—Yours,

HEZRON.

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ported according to the *usual* calculations—instance, Library of Useful Knowledge, Pneumatics, page 7, under article 15, et passim.

THE SOUTH WELCH COAL FIELD.

The transactions of the Nat. Hist. Soc. of Northumberland contain an interesting paper of observations, by Mr. Francis Forster, on the coal field, or basin, of South Wales. This field is stated to afford not only numerous beds of common bituminous coal, but also beds of what is provincially called glance coal (identical with the American anthracite). It is the source from which the Cornish smelt-houses derive all their supply of coal, and to which, according to Mr. F., London must look for a supply, whenever that period arrives, that the coal of the northern districts either becomes so scarce, or is so difficult or expensive to procure, that it cannot compete with that of Wales. The sides of the coal basin are of mountain-limestone, which rest upon the old red sand-stone. The coal formations exhibit the usual rocks and alternations. In some places the position of the strata appears to have been changed by some action after their deposition; in others, natural unaltered wavings of the strata occur. The quantity of carburetted hydrogen gas occuring in the Welch collieries is very trifling, as compared with the Durham and Northumberland districts; this, Mr. Forster remarks, may in some degree arise from the greater inclination of the strata, allowing the gas to find its way to the surface between the planes of the different beds; that it cannot be altogether attributed to the inferior capability of the Welch coal for the production of gas, is evident, from the remarkable fact, that the glance-coal seams generally abound more in fire damp than the seams of bituminous coals. Mr. F. calculates the quantity of coal in the whole basin to amount to about 16,000,000,000 of tons. The annual quantity of coal consumed in Wales, and exported from it, is stated to amount to 2,754,895 tons.

* * *

PURE CRIMSON.

To ascertain whether silk is dyed with a spurious crimson, take a small quantity of sulphate of alumina and dissolve it in ten times its weight of water; place the mixture on the fire till it boils, and then plunge in it a shred of the suspected article, equal in weight to the sulphate employed. If the liquor becomes red, it indicates that Brazil wood has been made use of; if cochineal alone has been used, the liquor will be of a pale colour.—*M. Ozanam.*

DESCRIPTIVE ACCOUNT OF THE PRINCIPAL BRIDGES ERECTED OVER THE RIVER THAMES. BY MR. C. DAVY, ARCHITECT.

No. XIX.

Mr. Allen's Claims. Mr. Rennie's second Plan for the Approaches.

It is a circumstance of not unfrequent occurrence, to see two or more ingenious individuals simultaneously hitting on the same invention or discovery. Connected with Mr. Rennie's designs for the approaches to the New London Bridge, are two striking cases of this description. With respect to the first—I mean that of Mr. Allen—the public have been rather more than sceptical. The facts are briefly these:—Mr. Allen, after devoting much valuable time to the subject of the approaches, completed, in 1826, a plan for the purpose, the prominent feature of which was the formation of a new street, commencing at the watch-house, near Bridge-yard, and proceeding towards the bridge to the south of the existing properties in Tooley-street, till it entered the Borough High-street at White Horse-court.* This plan, however, was not made public at the time; Mr. Allen being anticipated by a professional friend, who published a similar one in May 1827.

It is particularly deserving of observation, however, that it was not till *after* this period that the old line of Tooley-street, which was originally intended to have been preserved, was abandoned; that in three *new* designs, which were submitted by the Messrs. Rennie to the New Bridge Committee, the arrangements on the Southwark side were *all alike;* and farther, that the Tooley-street approach was line for line the same as that published by Mr. Allen's friend, in May, 1827. It was clearly seen that a part of Mr. Rennie's first plan was in the highest degree objectionable; namely, that which related to the formation of a street leading to the Bricklayers' Arms, † which should, in its course, pass through the centre of St. Thomas's and Guy's Hospitals—thereby carrying with it destruction to two of the noblest and most philanthropic establishments of which the country can boast.

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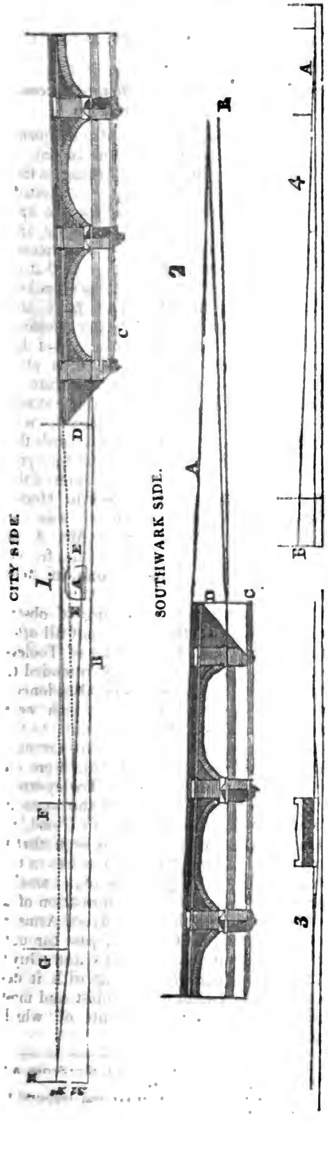
* See Monthly Magazine, vol. 7, New Series, Art. Metropolitan Improvements.

† The utility of such a street was suggested by another party.



With respect to the suggestions of those *not immediately* interested in the works, Messrs. Rennie's reports have been strangely deficient in candour and liberality. In one of his reports, Mr. Rennie, sen. speaks thus of the Tooley-street approach: "Tooley-street, moreover, might be made to pass under the embankments by a dry arch; but in that case another communication must be made for Tooley-street to enter upon the bridge, which might be productive of considerable expense and inconvenience; by giving, however, a little additional width at the entrance, I see no reason why it might not communicate with the bridge by means of the circular crescent, as mentioned above, preserving, at the same time, the dry arch under the road, which would thus answer both purposes. Either of these last plans would form an *immense* improvement, and it will require a little more time in order to come to a right judgment as to the best."* From the manner in which this plan was spoken of, Mr. Allen determined to submit his ideas to the Bridge Committee, and to show that it would actually be "a saving to the City of one hundred thousand pounds." As the Bridge Committee declined receiving his statement, it was, by permission, laid before the Court of Common Council; a plan by Mr. Gwilt, and another (the sixth) by Mr. Rennie, were also at the same time under the consideration of the City. A singular coincidence again occurred at this stage of the proceedings. The last three plans were nearly alike—and in fairness we must admit, that while there is doubt existing as to the originality of the plans of Mr. Rennie for the Southwark approaches (marked Nos. 2, 3, and 4), yet the three last plans, by Messrs. Gwilt, Allen, and Rennie, were designed without these gentlemen being previously acquainted with each other's proceedings. The principal suggestions with respect to the approaches on both sides of the river, having been made by professional gentlemen unconnected with the works, and yet agreed to and carried into execution by the committee, it was natural that they should claim remuneration, and but fair that they should obtain it. I consider the withholding from

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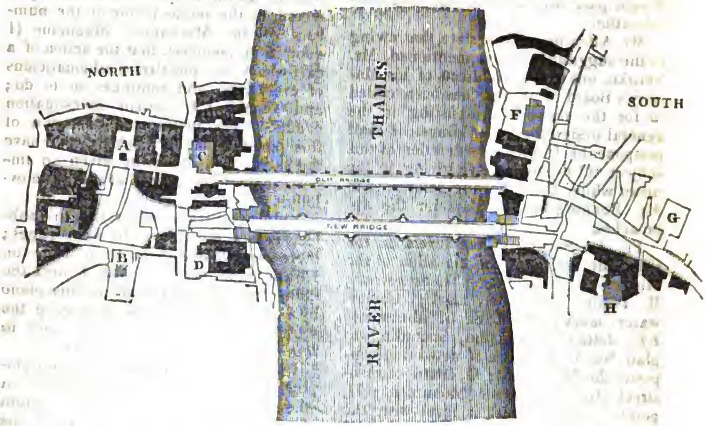
* Repertory.

2.



Mr. Allen of payment for the drawings and models which he furnished, particularly unjust.* The nature and extent of Mr. Allen's claims are fully set forth in a memorial (the fourth) presented by him to the Court of Common Council in July 1830, and of which the following is a brief abstract. Of mere cash out of pocket, Mr. Allen has expended nearly three hundred pounds in the preparation and publication of numerous memorials, engravings, drawings, plans, and models. He was encouraged so to do by the flattering reception which his previous suggestions and designs had received from the Court. In order to counteract the interested motives and parsimonious conduct of the Bridge Ward, he (Mr. Allen) was induced, in the autumn of 1828, to construct a model upon a very enlarged scale, exhibiting his designs for the future approaches extending from the River Thames, on the South to Cannon-street, and to Eastcheap on the North. This model was complete of its kind, showing, not only the different levels, but by means of coloured drawings fixed thereon, the whole of the then existing buildings, public and private, with the elevations of the new buildings, intended for the new lines of streets, further illustrated by numerous and elaborate models and carvings in wood and plaster.

In Mr. Allen's third memorial, there is a proposition of such vital importance to the architecture of this, and indeed of all countries, as regards city approaches, that any corporation but the City of London would (like the Grecians and Romans of old) have decreed him for it a votive patera, or inscription on some conspicuous edifice. The proposition was to this effect—that a general design should be prepared for the guidance of parties proposing to build in the new streets; "instead of each person being permitted to construct the principal front of his house, high or low, decorated or plain, as might suit the suggestions of his own fancy;—whereby, the buildings would be deprived of all general character, and the whole become a disgraceful piece of patch-work."—When Sir C. Wren suggested an uniform design to be adopted in rebuilding the City of London after the great fire, it is well known that he met with so many and serious obstacles, that he was obliged to abandon this magnificent feature in his design. The Corporation have for once, it appears, taken the hint so judiciously thrown out by Mr. Allen, and are not willing that the present opportunity should pass without receiving due consideration.

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* Mr. Allen would oblige by sending a copy of his other reports, &c., through the medium of the Editor.

Mr. Allen proceeds to state, that owing to the suggestions above mentioned, Mr. Smirke, one of the Architects of his Majesty's Board of Works, has been called in for the purpose of assisting in the general design for the buildings. I shall postpone the further consideration of this subject till my next paper, giving, in the mean while, the following references to Mr. Rennie's *second* plan for the approaches.

Fig. 1.—Section of the levels on the City side with half the elevation of the bridge. A, the arch over Thames-street; B, Trinity high-water mark; C, low water mark; D, back of abutment; EE, dotted line section, according to plan No. 4; F, centre of new bridge opposite the Monument; G, centre of Fish-street Hill opposite the Monument; H, point where the street is level with the roadway over the centre of the land arch.

Fig. 2.—Section of the levels, Southwark side, with half elevation of the bridge. A, centre of the bridge opposite the proposed line of Tooley-street; B, Trinity high-water mark; C, low-water mark.

Fig. 3.—Section of land arch with Thames-street.

Fig. 4. — Section of Tooley-street; A, Saint Olave's; B, back of the abutment.

The Plan, *No.* 2.

A, the Monument; B, proposed statue or Monument; C, Saint Magnus Church; D, Fishmongers' Hall; E, Saint Michael's; F, Saint Olave's; G, Saint Thomas's Hospital; H, Saint Saviour's.

(*To be continued.*)

THEORY OF LOCOMOTION.

Sir,—I am pleased with the subject of locomotive-carriage wheels being renewed in your pages, in consequence of the wheelbarrow problem introduced by Saxula; and though my attempt at solving his question was essentially different from his own solution, I assume that it is correct in principle till the contrary be shown. The subject itself I consider of great importance, and the ideas of your different correspondents, if given, may lead to useful results. It stands upon record, in the motto to one of the numbers of the Mechanics' Magazine (I quote from memory), that the action of a cart-wheel has puzzled mathematicians of every age, and continues so to do; and should the present investigation conduce to a better comprehension of this puzzling matter, Saxula will have the satisfaction of having given an important aid to the march of useful knowledge.

I must observe, however, that this subject is not *quite* new to your pages; there are two articles on it, p. 195, vol. 10, and p. 38, vol. 11. And, I think the difficulties in ascending an inclined plane by a locomotive machine, possessing the source of power within itself, were in some degree pointed out by J. O.

I consider the action of the power employed, when within the machine or when without, and through the medium of a line of traction, as it relates to the motion of a carriage-wheel, to be essentially different. In the former, in all the machines hitherto constructed, the force as it acts on the wheel may be considered a centrifugal force, and in the latter a central one; or perhaps, in regard to the former, it would be more correct to say, when a crank movement is employed to turn the wheel (the most general method) it is both one and the other. (See vol. 11, p. 38.) Still, though this mixed kind of force exerted by the operation of the crank, has its disadvantages when the object is to overcome resistance without any regard to time or velocity; yet it certainly has its advantages when velocity is required at the expense of power: the power acting in the direction of the diameter of a circle or moving in its parallels; whereas, were it continually acting in the direction of a tangent to the periphery of the wheel, it would, to produce the same velocity, have to pass through the semi-circumference of the circle; so that could a piston be brought to act continually on the periphery of a wheel in a tangential direction (as by means of a toothed rod, endless chain, &c., &c.,) the stroke would require to be lengthened in the proportion of about 11 to 7. From this it appears (to me at least) that a greater motive power or pressure is required in the use of a crank, to urge a certain resistance or weight up an inclined plane, than would be required were the power applied in the direction of a tangent to the circle.*

If the force conveyed by a piston-rod were to impinge on a point in the periphery of a wheel, and could be made to act upon it, preserving in its direction a perfect parallelism, advancing to and from the centre, it would still be but a crank movement, though the arm of the lever to which the power is applied would be lengthened agreeably to the idea of Mr. Clive (or Saxula as may be) and this would be in proportion, as this point is at a greater or less distance from the centre.

If these few hints should tend to further investigation of a subject, which I consider to be an interesting one in a practical point of view, you may probably hear again upon the same from—Yours, &c.

HEZRON.

P.S.—I think B. C., on a reconsideration of his familiar way of explaining how Saxula appears to have been misled, will find it is not sufficiently familiar to be convincing, at least to those who, as Saxula expresses it, have a roundabout way of reasoning. For my own part, I consider this the best way, and certainly no one will deny but the subject itself is a roundabout one. B. C. in his illustration, seems to me to have given an example of a lever of the third kind,—the power applied between the fulcrum and the resistance. He then reverses the effects, by assigning the resistance and power to the opposite ends of the lever, and must, to produce the effect he proposes, reverse the direction of the power also; he then says, the weight or point of resistance being moved, becomes a moving fulcrum, &c. I do not understand this: I always thought the fulcrum or prop to be the immoveable point, sustaining the sum or difference (as the case may be) of the power and resistance.

Still, if B. C. will favour us with something a little more intelligible, on the nature of moving fulcrums (if such things are), it would be interesting to those who, like myself, may feel a desire for information on so interesting a subject.—H.

NOTICES OF RECENT AMERICAN PATENTS. BY DR. JONES, SUPERINTENDENT OF THE PATENT-OFFICE, WASHINGTON.

(Selected and abridged from the Journal of the Franklin Institute.)

MACHINE FOR MAKING SHOT AND MUSKET AND RIFLE BULLETS, *Julius Willard, Baltimore.*—This machine is intended to manufacture balls by first casting and afterwards condensing them by rolling. Several abortive attempts have been made to manufacture bullets by pressure, so as to condense and equalize them; the failure has not resulted from any real difficulty in accomplishing the object, but from the increase in cost. The present plan exhibits a good arrangement for the purpose. The balls are first cast in moulds, consisting of two iron plates, faced so as to fit closely together; the lower plate forming one half of the bullet, and the upper plate the other half. The thickness of the upper plate is just equal to that of the half bullet, there being a hole through it above each for the purpose of casting. These plates are so placed as to form an inclined plane upon a frame made for the purpose. A hopper to contain lead to fill the moulds is made to slide over, and in contact with, the upper plate, and is followed by a knife, which removes all the superfluous metal. The hopper is borne down by a weighted lever, and moved by a rack and pinion. On being turned out of the moulds, the bullets are coated with black lead to prevent their adhering, after which they are passed through the rolling-machine. This consists of small hoppers, into which they are first put, and by which they are delivered on to grooved rollers properly adapted to them; of these there are five which they pass in succession, each with the grooves a little smaller than the preceding one.—*Date of Pat., 10th July,* 1830.

IMPROVED THRESHING-MACHINE, *John Stowits, Gorham, State of New York.*—The ordinary threshing-machines are so constructed that the main cylinder catches the straw at the *lowest point* in its revolution, and of course throws the straw, grain, and chaff, upwards; they then fall together in a confused mass; this renders it very troublesome to the person employed in separating the refuse from the grain; and while the machine is in motion the place he must occupy is filled with dust. The velocity of these machines is such, and their power so great, that grain, and even stones, sticks, and weeds, will greatly annoy, and sometimes injure, the person so employed. By this improvement all these objections are avoided; a concave piece of wood, filled with teeth of proper size, is placed at the *top* of the machine, and the cylinder, also filled with teeth, plays into this, and the straw to be threshed is put on an apron leading to the top of the cylinder; the course of the straw is therefore downward, and it falls on a sieve. A blower in the lower part of the machine, fixed as in the ordinary farming, separates the refuse from the grain. The straws of ordinary length, by the force which they acquire in the revolution, are thrown beyond the main body of the grain.—*Date of Pat.*, 13*th July*, 1830.

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* It is of course assuming in each case that a fulcrum is obtained, if a lever power is employed; *and here lays the rub.*

PROCESS FOR EXTRACTING CREAM FROM MILK, *Samuel Davis*, *New York*.—Put zinc, commonly called spelter, into the milk-pan, or put the milk into a vessel made of zinc, and the same quantity of milk will yield a greater quantity of cream or butter, and of a much finer flavour than could otherwise be obtained; besides which, the acrimonious substance that causes milk to become sour or rancid, will be decomposed. We believe this application of zinc to be really "new;" whether we may add "and useful," we very much doubt. We cannot conceive any action which can be exerted by the zinc in an earthen milk-pan, or of any which can take place between it and the milk, unless the acid of the milk as it is formed dissolves a portion of the metal; and in this case a *poisonous* salt will be formed. Zinc is among those metals which are most readily attacked by acids, and all its soluble salts are deleterious. If the effect be as stated, namely, that the milk containing the zinc will not become sour or rancid, we know of no way in which this can be explained but by the formation of a metallic salt.—*Date of Pat.*, 10*th July*, 1830.

MACHINERY FOR SCOURING FLOORS, *David Dickinson*, *Chatham*, *Connecticut*.—A scrubbing-brush is to be worked backwards and forwards by a lever, operating in the manner of a pump-handle. A flat board is to stand upon the floor, and from this is to rise two uprights to sustain the pin which is the fulcrum of the lever. To the lower end of this lever the scrubbing-brush is to be attached by a joint. The board, with its appendages, is to be moved about the floor, that the brush may be applied to every part of it, &c. &c. We have seen many machines, some of them white, some yellow, and others black, which worked scrubbing-brushes to admiration. Some of them were very clever-looking articles, and although unpatented, we should decidedly give them the preference, either for washing, scrubbing, or other useful operations in domestic economy. They may either be hired or purchased, as may be thought most convenient.*—*Date of Pat.*, 10*th July*, 1830.

(To be continued.)

LETTER FROM INDIA, CONTAINING AN ACCOUNT OF THE DISCOVERY OF COAL AND OF A PROJECTED RAILWAY IN THE PROVINCE OF CUTCH, INDIAN PROCESS OF SMELTING IRON, &C.

(To the Editor of the Mechanics' Magazine.)

Sir,—Great interest is at the present time excited on this side of India, by the attempts of some individuals to get up a continuous intercourse between England and India *via* the Red Sea, by means of steam-vessels. Next to the vessels themselves, of course, the chief article requisite is fuel, and a bed of coal having, of late years, been discovered in the province of Cutch, perhaps a short account of it, as well as the other products of that country, may not be unacceptable.

Cutch is situated between 22° 24′ and 23° 49′ of N. lat., and 68° 34′ and 77° 6′ of E. long., and its chief port, Mandavie, averages 10 days' sail from Bombay, in the common native boat, or patimar.

Cutch may be considered as the (present) western boundary of our Indian empire; and though the internal administration of the country is in the hands of the ministers of the rao, or raja, who is a minor, yet there being a subsidiary force close to the walls of the capital Bhooj, which is under the controul of the resident, who is also a member of the regency, which consists of four besides himself—the real power is, of course, in the hands of the buoyancy. Perhaps no part of India presents a better field for mineralogical researches than Cutch, be it for amusement or profit. The whole of the country, which contains several ranges of hills, is composed of sand and sandstone; it is in general barren, and the only vegetable products for which it is celebrated are carrots, dates, and the thin jungle-grass near Bhooj, which renders Cutch mutton the finest in India; but the chief riches of Cutch are, for want of a good native government or an enterprizing class of individuals, still condemned to lie unsought in the bowels of the earth. Iron ore (of which a small quantity is smelted at a place called Doodye, 30 miles from Bhooj, and the process for which I will hereafter show) is inexhaustible, every stone visible containing it. Sulphur is found in many places, and I have seen many stones which apparently contain copper, but had not an opportunity of examining them. I was also informed, while in Cutch, by one of the natives, that a short time previous to its occupation by our troops, a vein of silver was discovered by a ryot, but he was forbidden by the rao, on pain of death, to show it to any one, lest it should tempt the cupidity of the rulers of the neighbouring country of Sind.

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* "Hired or *purchased!*" Will this stain on the national character of our American brethren never be washed out? It was lately moved in Congress, that the President should be instructed to use his best exertions to have trading in slaves declared piracy by the universal consent of nations. How monstrously inconsistent, while domestic slavery is still an established and cherished practice of a large portion of the American Union—when a man of such intellectual and moral eminence as Dr. Jones, can talk in a merry strain of scrubbing-brushes and fellow-creatures, as equally articles of purchase and sale.—ED. M. M.

But, probably, the most valuable of the minerals of Cutch is its coal, of which a bed was discovered a few years ago; and which, were it properly worked, I have no doubt would afford that useful article in abundance. The mine is situated on the banks of a nulla, which, like all small rivers in the country, is nearly empty during eight months of the year, while after a heavy fall of rain it rises from ten to twenty feet. The entrance to the mine (which is at present worked at the Company's expense) is a few feet above the level of the bed of the nulla, and, if I recollect right, about 25 feet below the surrounding country, which is a stratum of sand-stone; consequently, during the wet weather, the mine is full of water, and even in the driest season, not having any mechanical means of getting rid of it, they are precluded from digging below the level of the bed of the river, into which all the water now collected in the mine from springs, &c., is drained. A shaft had been sank about 50 yards from the bank of the river, in which direction they were mining when I was there in 1827. The coal dips at an angle of about 10° with the horizon, and is only a few inches (about nine I think) in thickness; it is of a light kind, burns well, and has much the appearance of compressed charcoal. I have no doubt, that were engines to be erected for the purpose of keeping the mine clear of water, they would find other and more valuable strata of coal at a greater depth. I believe the works have not proceeded much since I was there, three years ago.

The next thing to be considered is, the most advantageous manner of transporting the products of the mines and foundries to the nearest sea. Perhaps no country in Europe, Asia, or America, is more destitute of water than Cutch—artificial canals are consequently out of the question; the nulla, or river, on the banks of which the mine is situated, being a mere torrent in the wet weather, and nearly dry during the hot months, offers no possibility of being navigated, not only because of the large and numerous rocks which are scattered over its bed, but because its waters, flowing into the Runn, which is during four months in the year a shallow inland sea, and, in the hot months, a flat plain covered with salt, as far as the eye can reach, having exactly the appearance of snow, and only inhabited by antelopes and wild asses. The only mode of conveyance, therefore, likely to answer would be by rail-roads, which, by reason of the abundance of iron and number of lohars or blacksmiths in Cutch (who are considered the most expert in India), would not amount to a great sum. The pay of a good blacksmith is about 10 rupees, or 17*s.* 6*d.* per month, a labourer receives about 10*s.* 6*d.* per month. The distance from the coal mines to Bhooj is about six miles, through a tolerably flat country; from thence to a range of hills, which I should not think exceed three hundred feet in height, and onwards to Mandavie, the nearest sea-port and chief mart of the commerce of Cutch (with Surat, Bombay, the Malabar coast, Arabia, and the coast of Africa) is about 36 miles—total distance about 45 miles. At Mandavie there is a fine haven, or arm of the sea, which offers every facility for exportation.—Yours, &c.

BENGEIR.

P.S.—At Doodye, 30 miles to the eastward of Bhooj, there are two or three furnaces for smelting iron, the process and apparatus of which are extremely simple; in the middle of a shed are built two walls, about 2 feet apart, 5 or 6 in length, 3 high, and 9 inches thick; between are placed alternate layers of ore and charcoal; the bellows consist of two leathern cylinders, 2 feet and a half high, and a foot in diameter, with a wooden top and bottom; the latter is fixed to the ground, and contains the valve and pipe for the egress of the air; the tops of these cylinders, which are entirely independent of each other, are alternately raised and depressed, thereby affording a constant supply of air; the melted metal runs through an aperture at the bottom, and in the centre of the wall, into a hole in the ground, after which it is formed into ingots, a foot in length, 4 inches broad, and 3 thick, and is then ready for sale. I did not see the latter part of the process, but the ingots or pigs are evidently forged, not cast.

BENGEIR.

Guzerat, Sept. 27, 1830.

IMPROVEMENT IN SEWERS—NEW BUILDING ACT.

The writer of the present communication begs to submit to the serious consideration of the gentlemen concerned in framing the New Building Act, the propriety of making provision for the introduction of air-traps in all new communications with the main sewer, to prevent stench and vermin from getting into dwellings and warehouses, to the great discomfort and loss of their occupiers. Being himself seriously annoyed with the noxious vapours arising from a public grating opposite his house, and even materially injured in his trade, as no one in certain states of the atmosphere would come near the spot, the writer, who had seen, from the Mechanics' Magazine, that there was a remedy for the grievance, conferred with his neighbours on the subject, and the result was that they unanimously joined him in a petition to the Commissioners of Sewers for liberty to put down an air-trap. On the petitioners proving their case, the Board were pleased to grant their request. Since then, the neighbourhood has been entirely freed from its old nuisance, and the trade and health of every individual in it much improved.

T. T.

[We presume our correspondent alludes to the plan of Mr. Cuff, described in our 319th Number, and followed with so much success in the city of Boston (United States). We have heard with much pleasure, that the London Commissioners for Sewers have come to a resolution to give every necessary facility for its adoption throughout the limits of their jurisdiction. —ED. M. M.]

A WORD OR TWO ON FREEDOM OF INQUIRY.

Sir,—The importance of free discussion to the clearing up and right understanding of all matters submitted to its searching ordeal, is universally acknowledged. So much, at least, is certain, that those periodicals are the most flourishing, the most useful, the most extensively-influential, which afford the freest scope to the reasoning faculties of the public. It is an old observation, however, that it is not all freedom that is equally wholesome. To be at liberty to say what we please, and to say only what we ought, are two very consistent, and, at the same time, very different things. The single end of all grave discussion should be truth; and, whenever a controversialist aims at less or more than this, there is an abuse committed of the freedom of speaking or writing, which all good men and all rational lovers of liberty, must unite in deploring.

I have sometimes thought that I observed a strong tendency to this sort of abuse, in the pages of my otherwise favourite journal, the Mechanics' Magazine. I refer particularly to some late discussions, not of themselves (to my mind) of very great importance, but remarkable for the very virulent spirit in which they were conducted. The *cutting-up* style of some of the parties (as it is technically called, I believe) was really liker the tomahawking of savages, than the work of civilized beings. They seemed to act as if they thought all the honour of victory consisted in carrying off the scalp.

I will not presume to say how far it might have been in the power of the Editor to restrain this licentiousness; I recognise all the difficulties of his situ ation, as our master of the ceremonies; and were I to blame him for not insisting on greater respect being shown to the decencies of life, he might perhaps retort upon me, that he had but failed in accomplishing within his little circle, what the ablest and firmest judges in the land, surrounded by all the pomp and circumstance of judicial dignity, had been at times unable to accomplish within theirs.

Why, then, have I taken up my pen? Simply to express the great satisfaction I feel at observing the kindlier feelings which appear to have taken possession of the contributors to the Magazine since the present volume commenced. I begin to hope that, with a new volume, we have actually turned a new leaf. Saxula has made the *amende honorable* for some very uncourteous expressions; but though still sarcastic, is gentlemanly withal; Mr. Baddeley seems again content to instruct and entertain us by simple matters of fact; and a certain person, who shall be nameless, can even animadvert without anger on the misrepresentations of the *Manchester Guardian*. I have my fears of the Author of the Voice of Reason from what is stated among the Notices to Correspondents in No. 398; but if the Editor will only adhere to the determination he expresses of confining the gentleman to what is "material," the interruption to the general harmony, which is threatened from this quarter, may yet be happily averted. The ingenious Mr. Harrison is silent, but occupied, I presume, in preparing for some forthcoming Number a description of the admirable clock-escapement and fly, for which he received a premium at the last annual distribution of the Society of Arts. His antagonist, S. Y., is also silent; I trust it is not because he thinks his "occupation gone;" he has good parts, and if he could only command his temper, might yet cut a figure in the scientific world.

Oh! that he and every one would but be duly impressed with the sublime truth contained in the following lines, quoted by yourself, on a former occasion, as the production of the celebrated John Wesley, but sought for by me in vain throughout his works.*

"Seize upon truth where'er 'tis found,
Amongst your friends, amongst your foes;
On Christian or on heathen ground,
The flower's divine where'er it grows."

Yours, &c. B.

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* We believe Wesley to be the author, but regret that we cannot at present give our authority.—Ed. M. M.

MISCELLANEOUS.

Herne Bay Pier.—An Act of Parliament has just passed for the erection of a pier at Herne Bay, on the Kentish coast. The pier, according to a design furnished for it by Mr. Telford, is to extend so far into the sea, that steam-vessels will be able to embark and disembark passengers and goods at all times of the tide. Herne Bay is situated four miles on the London side of the Reculvers, and is of course sixteen miles nearer than Margate; the sea there is pure, and free from weeds; the sands are dry and extensive; and the surrounding scenery exceedingly picturesque.

Gelatinous Biscuit.—There were manufactured for the French expedition to Algiers, 344,728 biscuits, each containing one ration of gelatinous solution, or 10 grammes of dry gelatine. These 344,728 biscuits contained as much solid animal substance as the broth of 86,182 kilog. (about 183,843lbs. Eng.) of butcher's meat, or all the flesh of 287 oxen.—*Recueil Industriel.*

Prejudice against Machinery.—In one of the districts not 50 miles from London, where a violent fury was lately raging against machinery, about the middle of last century the same hostile spirit and tumults occurred on the introduction of broad-wheeled waggons. In a borough of the district there happened to be at the time four candidates to represent it in Parliament. The parties were divided into narrow and broad wheels. It is tautological to say, that the narrow wheels were the popular party. The two candidates who stood on the broad-wheeled interest could not make their appearance without being hooted and pelted by the rabble.—*Mr. Simon Gray; British Farmers' Magazine.*

Mr. Perkins's Paddle-Wheels.—A Mr. Doolittle states in a communication to the Journal of the Franklin Institute, that paddle-wheels on the plan for which Mr. Perkins has a patent, are now in successful use in an American steam-boat called the *Novelty*. Mr. D. questions, however, Mr. P.'s claims to originality in the invention.

INTERIM NOTICES.

The Appendix to Vol. XIV. containing Answers to all the Mathematical Questions unsolved in the course of the Volume, and a valuable original Table of the Dimensions of all the Steam-Vessels employed in St. George's Channel, and their Machinery, is now ready. Also Supplement to Vol. XIV. containing Titles, Preface, and Index; with a Large Sheet of Autographical Memorials of upwards of One Hundred Eminent Men of Science, Engineers, and Mechanics of the Nineteenth Century. Vol. XIV. may be also had complete in boards, price 8s. 6d.

A "Subscriber" will find the arithmetical difficulty to which he alludes, fully discussed in our first Volume.

Communications received from A. B. C. jun.—Mr. M. Lawler—Mr. Greenall—Hezron—Dr. Fox—B. C.—B.—Mr. G. Spratt—An Etonian.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

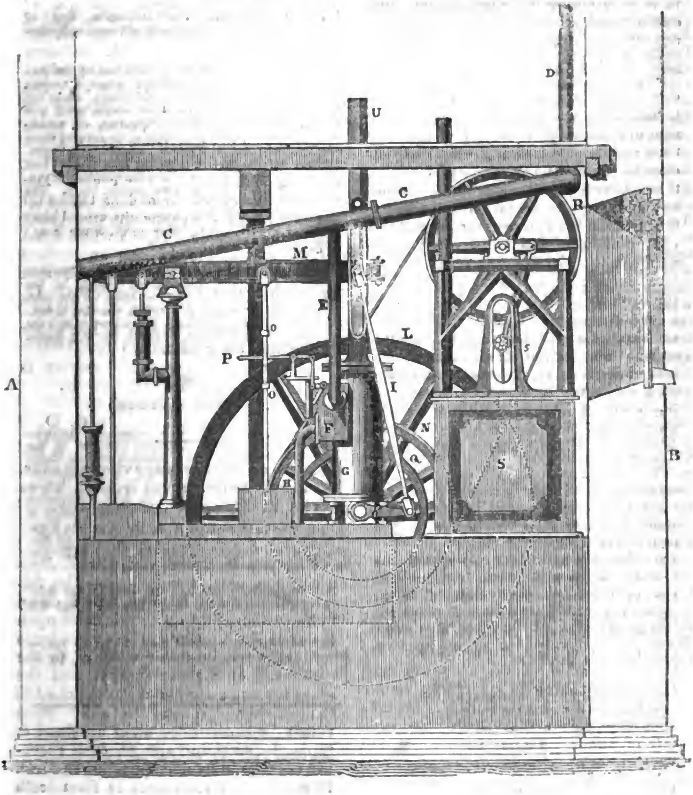
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 402.] SATURDAY, APRIL 23, 1831. [Price 3*d.*

" For one person who is blessed with the power of invention, many will always be found who have the capacity of applying principles and much of the merit ascribed to these applications will always depend on the care and labour bestowed in the practical detail."—Babbage.

STEAM-ENGINE FOR A SUGAR HOUSE.



DESCRIPTION OF THE VARIOUS PRACTICAL MODIFICATIONS OF THE STEAM ENGINE, BY MR. C. DAVY.

(Continued from Vol. VII. Mechanics' Magazine, and Vol. XV., page 67.)

STEAM-ENGINE FOR A SUGAR-HOUSE.

The rapid improvements that have recently taken place in the art of refining sugar, have been chiefly owing to the employment of steam as an auxiliary. The processes invented by the Hon. E. C. Howard, and now so generally followed are numerous, ingenious, and useful. Mechanical ingenuity, as a late contemporary well remarks, too often "serves merely to amuse the mechanician, and curious and scientific inventions remain unprofitable speculations till they are applied to the useful purposes of life. The portion of inventive talent which is directed to the construction of useless trifles, will be diminished by the extension of information; for man employs his time and talents uselessly only when he does not perceive the means of applying them beneficially." The many important additions made by Mr. Hawkins to the inventions of Howard, furnish a strong confirmation of the truth of these remarks, not only showing great mechanical ingenuity, but some very decided improvements. It is not, however, my intention (at present) to describe the economy of sugar refining, but to show, in what manner the steam-engine is employed in Sugar Refineries, and one of its simplest modifications. The engraving prefixed to this communication represents a condensing engine; its power is employed to work a sack tackle sugar-mill,* and a powerful air pump for exhausting the vacuum pans (peculiar to Howard's patent). It will be readily imagined, that the steam-power required is not very great—an engine of six or eight-horse power being sufficient for the general operation, and one of less where the mill is dispensed with. The air-pump may be attached to any engine; but by the improved plan it is placed in the cistern of the steam-engine. For this application of the air-pump, and the plan of boiling in a vacuum, we are indebted to the late Hon. E. C. Howard; whose knowledge that the natural crystals of sugar were perfectly white, but surrounded with molasses, led him to the discovery of this mode of preserving the crystals and withdrawing the molasses. The engine represented in the prefixed engraving was employed in a sugar-house fitted up with Mr. Howard's apparatus; A and B are sections of the walls; the two steam-boilers are fixed adjoining the wall, and over them is the drying stove, which is heated by steam from the boilers. C C, the steam main for communicating heat and steam by the pipe D, to the other stages or floors of the house and the vacuum pans. E, smaller main for the supply of the cylinder of the engine. F, the valve box. G, the cylinder. H, eduction pipe to condenser. I, connecting rod. K, the crank. L, the fly-wheel. M, the beam with the different pump-rods; short strokes being required at one end, the beam has its fulcrum considerably on one side of the centre. The steam valve is worked by the two tappets OO, alternately striking the lever P, and thereby opening and shutting the cocks. The parallel motion at the end of the beam is obtained by the connecting-rod being guided by the slide. N, is a wheel fixed on the axis of the fly with an endless band passing over the wheel R, and giving motion to the air-pump S S. Q, bevel gearing] working the shaft U, connected to the sack tackle. The other parts are so clear as not to require any particular explanation. The engine is represented as on the quarter-stroke.

Yours, &c.

C. D.

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* This is supposing that the whole of the apparatus is employed as in the West Indies.

NOTICES OF RECENT AMERICAN PATENTS. BY DR. JONES, SUPERINTENDENT OF THE PATENT-OFFICE, WASHINGTON.

(Selected and abridged from the Journal of the Franklin Institute.)

PRESSING MACHINERY, *Lector E. Dennison, Saybrook, Connecticut.*—The follower of this press is to be forced down by the action of two eccentric cams upon the same shaft. One of these cams bears against a friction-roller attached to the upper rail of the press-frame, and the other against a similar roller attached to the follower. When the shaft upon which the cams or eccentrics are fixed is turned by means of a lever, each eccentric operates in forcing the follower down. It is proposed sometimes to form teeth upon the cams and on the friction-rollers, in which case the lever may be applied to either of the friction-rollers instead of to the eccentric, as they will then operate as pinions. Presses to work by eccentrics have been before patented, but the mode of applying two eccentrics in the manner here described we believe to be new. As no power, however, will be gained by this arrangement, and it is more complex than a single eccentric, we do not perceive what advantage is offered by the proposed plan.—*Date of Pat.*, *Oct.* 1, 1830.

New Materials for Horological Machinery, *John B. P. Bakewell*, *Pittsburgh.*—This new material is glass, which is forcibly compressed when in a melted state between moulds or dies, in which an indentation or cavity has been made of the size and form intended to be given to the wheel, pinion, &c. The poles for the axles may be either made in the same way or drilled after the glass is cold.—*Date of Pat.*, *Oct.* 1, 1830.

New Method of Saccharification, *A. J. Brasier.*—The grain, or other vegetable substance containing fecula, is put into water, acidulated with from 2 to 4 per cent. of sulphuric acid, and the water is raised to the boiling point, at which it is kept during the process. The heated water first converts the fecula into a mucilage, which is afterwards liquefied by the action of the acid, and this liquefaction is stated to favour the saccharification. The time required for the operation varies according to the fineness of the grain, and the quantity of acid used, from six hours to four days. The patentee ascertains when the saccharification is completed by means of the tincture of iodine, which ceases to give a blue or purple colour to the liquid as soon as all the fecula is saccharified. He adds, that since taking out his patent he has ascertained that the common potatoe has already been saccharified by a similar but more laborious process; it being necessary to reduce it in the first instance to a pulp, &c. He finds that the saccharification of the potatoe can be effected by exposing it entire to the combined action of heat and of acidulated water.—*Date of Pat.*, *Oct.* 1, 1830.

Rotary Steam-Engine, *Ezek. Childs*, *Philadelphia.*—In this engine the steam is admitted and discharged through the centre of the revolving-shaft in a way frequently adopted. The steam operates on a piston, revolving in an annular chamber, which is also precisely the method adopted in other rotary-engines. The two valves which are to confine the steam are sliding-valves, which operate very much like those of (Elijah) Galloway's engine, patented in England, but the construction as well as mode of working them appears to be more perfect. We do not believe this machine will be found equal to the ordinary reciprocating engine, although we think more favourably of it than of its predecessors. In general, we estimate rotary-engines as very unpromising affairs.—*Date of Pat.*, *Oct.* 1, 1830.

Improved Water-Wheel, *J. Johnson*, *Indiana.*—This is a wheel with hinged buckets or floats, arranged in a new manner. Hinged buckets have been tried in almost every possible variety of form, but have hitherto always disappointed the hopes of their projectors. The hinged buckets pass far beyond the point at which they *ought* to open, according to the opinions of those who construct them. We do not see any thing in this new wheel which should give it a superiority over others of the same genus; on the contrary, we think it really inferior to several that have had an ephemeral existence.—*Date of Pat.*, *Oct.* 1, 1830.

Paper from Wood, *Lewis Wooster and Jős. E. Holmes*, *Meadville*, *Pennsylvania.*—The wood (any wood) is reduced to shavings, which are thrown into a cauldron of water and set to boil. To every 100lbs. of shavings from 12 to 18lbs. of any vegetable or mineral alkali (according to its strength) are added. One hundred pounds of wood will, if well attended to, make from five to seven reams of paper.—*Date of Pat.*, *Aug.* 3, 1830.

(*To be continued.*)

AMERICAN SLAVERY.

"Say, was that lordly form inspired by THEE.
To wear eternal chains, and bow the knee?
Was man ordain'd the slave of man to toil,
Yoked with the brutes, and fetter'd to the soil;
Weigh'd in a tyrant's balance with his gold?
No!—Nature stamp'd us in a heav'nly mould!"
Campbell.

Sir,—It is, indeed a consummation devoutly to be wished for, that slavery should be banished from the face of the earth; and strange, most strange it is, that America, the land that boasts most of liberty, should not only permit domes-

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tic slavery, but lay such arbitrary and grinding restrictions on the free negro. The natural consequences of so incongruous a state of things are beginning to be felt, and the tyrant-freemen of the Western world already tremble at the apprehension of that re-action, which must sooner or later spring from the physical strength and moral feeling of their black brethren. As the state of slavery in America is not very generally understood in this country, perhaps the following concise account may not be considered useless or uninteresting. My attention has been directed to this subject by a note of yours, in your last No. page 109.

In thirteen of the United States, slavery has been abolished by law; in the other eleven it exists in full vigour, modified according to their different systems of government. Free blacks are dreaded more than slaves; the whites have a strong dislike to intercourse with them, so that an intermingling of the two races is effectually prevented. The slaves are discontented when they behold their free brethren, who generally lead an idle and careless life. In South Carolina, every one entering with a black servant is deprived of him at the frontiers, nor is he returned until the traveller is about to depart; till that time he is *kept in prison*. The reason for this law is, that fear is entertained lest the free blacks who might enter the state should excite tumults among the slaves, for the emancipated negroes are very fond of talking about liberty. A negro, free or not, cannot travel without a passport: if one is not produced, he may be stopped by any white till evidence of his freedom is procured, and placed in a jail. Some states, to get rid of free blacks, lay a heavy capitation tax on them, and authorize their sale if they are unable to pay it. In *most of the States*, they may be sold to pay the debts of their masters, contracted before their emancipation; and they are even sold to defray the expences incurred in their imprisonment, if detected travelling without a certificate of their freedom! Thirteen of the States, by their constitution, expressly forbid them to vote; and in all others, save New York and Pennsylvania, they are excluded from this privilege by special laws Some of the Southern States forbid them to enter their domains under severe penalties—this has given rise to long debates in Congress, respecting the constitutional character of the power thus assumed. The constitution of the United States declares, "the citizens of each state shall be entitled to *all privileges and immunities* of citizens in the several states;" a free black of New York is a citizen of that state: and yet, in the Southern states, he is forbidden to exercise his legal rights—a plain and shameful violation of the Constitution, which all the states are bound sacredly to observe!

In some states slaves are only permitted to emancipate, on condition that *they leave the state immediately!* The question of allowing blacks to be members of the legislature, was on the admission, in 1821, of Missouri into the Union, made a subject of strong debate. A provision to this effect was passed, but on the understanding that it should not apply to the citizen of any other state. This, commonly called the Missouri question, violently agitated the whole Union at the time of its discussion; and the renewal of the question at any time is considered as likely to shake the Union to its very basis.

This brief sketch of slavery in America does not exhibit our brethren of the United States to advantage, either as philanthropists or politicians. On the jesuitical ground of expediency, one might suppose they would do all in their power to conciliate the feelings of so increasing and powerful portion of the community as their black brethren. Let us hope that this foul blot will not long stain the starred flag of American honour and liberty.—Yours, &c.

T. M. B.

April 16, 1831.

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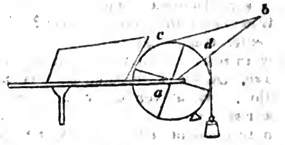
THEORY OF LOCOMOTION.

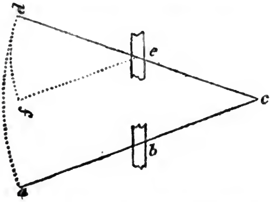
Sir,—I had flattered myself that my last communication respecting Saxula's wheel-barrow problem, and his theory of locomotion, would have sufficed to convince him of his error, especially as I pointed out to him, that by the simple means of a few slips of wood, he could arrive at an experimental demonstration, that locomotion was practicable under those circumstances, in which he pronounced it to be impossible. I am, however, much gratified with the pleasant temper and candid spirit which is displayed in his reply; and only wish, that as he professes a desire "to seek information as well as to give it," that he had adopted more of the tone of a disciple than that of a master. I do not blame him for stoutly maintaining his own opinion—supposing always a willingness to be convinced that it is erroneous—more especially as that opinion, it may be, is a pet one, and as he himself hints, long and fondly cherished; but I would put it to his good sense, whether his scoff and scouting of the anticipated distinction between fulcrum and abutment, and his determination to resist the force of further argument, betray not a too great indulgence of a sanguine and impetuous temperament. A merciless opponent would advert, in reference to this reply of Saxula, to his own luckless but appropriate quotation—"For e'en when vanquished he can argue still;"—but as I have fairly entered the ring, and am brought to the scratch, as he says, I am disposed, according to the usual practice, to shake hands with him before the encounter begins. But to the point:—Saxula has given a diagram of a wheel-barrow, with a weight suspended to the wheel, in advance of an obstacle to be surmounted, and says that the wheel will go round without progressing. He should have investigated the reason of this, and he would have found, that the only impediment to locomotion was the want of sufficient hold of the ground. Let him imagine it to be a cog-wheel and a rack, and he will not hesitate a moment as to the result. But then how did he, by means of his own gravity, trundle himself and barrow up a hill without that help? Simply, because part only of his weight, was employed as a power, and the other part remained as a load on the wheel, to afford by its adhesion to the road a sufficient resistance for progressive motion. And it is the proportional adjustment of these two portions of his weight to which he refers, when he says, "this curious problem, when a maximum can only be solved by the nicest arrangement of gravity and *muscular action*." And here I shall be met with the objection, that "the man's weight rested on the side bars," and that only muscular force was employed as the motive power.—This was certainly the case when Saxula sat on the fore board of the barrow, and pushed the wheel round with his hands. But he speaks of producing his maximum effect (No. 385) "by throwing all the *weight* of his body backward, but having hold of the wheel by its felloes."



The line *ab* will therefore represent the direction of his body, and *bc* that of his arms. Now, let him candidly say, whether this is not the case of a wheel always loaded on one side, and that the muscular action is chiefly for the purpose of keeping the centre of gravity, *d*, in the right position—I say chiefly, for I do not deny that it contributes directly, in some degree, towards producing locomotive effect, and it may be made to do so considerably, by a peculiar bow-string extension of the muscles. Saxula will perceive that there is a climbing of the wheel on its outside, whatever else there may be beside. So far, therefore, as his weight acted as a power, so far he was not *carried*, that is, so far it did not constitute resistance; and this explains what I meant by saying, that he had confounded power with resistance. The dispute, therefore, is not verbal; but I acknowledge that Saxula's ride does not come up to Pat's, though I was certainly reminded of Paddy's exploits.

We now come to the question, which Saxula admits is decisive, of the merits of his locomotive theory. It is, whether in the act of rowing, the fulcrum of the oar or lever is in the water, or on the boat? The affirmative to the latter, I again say, is the true answer. If I am right, Saxula's theory is confessedly false; but it does not follow that it is correct if I should be wrong. I acknowledge that all the authorities are against me. If Saxula had consulted a score of them, he would have found that they are all agreed on this point, or rather that they have all followed one another in committing what I consider to be an oversight. The Treatise on Mechanics, published under the superintendence of the Society for the Diffusion of Useful Knowledge, and the Essay on the Lever, by Mr. Ward, which was deservedly rewarded by the London Mechanics' Institution with the first prize, a year or two ago, contain the same erroneous statement.

What is the fulcrum of a lever? It is its centre of motion; and, therefore, it is only in reference to this point that any power, as an acting force, has any motion. Whatever other motion the power may possess in common with the fulcrum, whether extraneously acquired, or the result of its own action, it is only in virtue of an imparted angular motion that it can have any mechanical efficiency, and to produce which it must necessarily be present with the fulcrum. This statement of the case, if admitted, is alone decisive of the question; for it follows, that as the power is in the boat, the fulcrum must be there also. But this point will be more satisfactorily proved, by a reference to the power of the lever, which is governed by the relative distances of the force and the resistance from the fulcrum. If an oar is a lever of the second order, which is the opinion that I oppose, it will always have, and necessarily must have, a mechanical advantage; and supposing it to be pivoted at its middle, it will have a double power, that is to say, the *acting force* will move twice as far as the resistance. Now is this the fact?



Let *ac* be an oar pivoted at the middle on the edge of the boat *b*, and be moved from *a* to *d*. The effect produced, is the motion of the boat from *b* to *e*, and this is accomplished by the motion of the force from *f* to *d*. Now these are equal distances, and can only take place with a lever of the first order, which, has its fulcrum midway between the force and the resistance. It is, therefore, situated at *b* or *e* on the boat, and not at *c* in the water. That the force, in respect to its efficient or relative motion, moves the distance *f d*, which is the range it takes *in* the boat, and not the distance *a d*, is too evident to admit of dispute. It is analogous to absolute and relative velocities. The remark would be true of *a d*, if the force had a common abutment with the point *c*, that is, if the oar were moved by a person on the shore—then indeed it would become a lever of the second order; and while the power moved the distance *a d*, the resistance would be moved half the distance *b e*, supposing the water fulcrum at *c* to be immovable. But the power is in the boat, and at the same time that it moves, it is *being moved;* therefore, its absolute motion *a d*, is compounded of the motion that it has in common with the fulcrum, and of its own motion in regard to it, (which last is the only efficient one), that is of *b e* and of *f d*.—A more formal demonstration is certainly needless—it contains most assuredly quite sufficient proof to satisfy Saxula or any body else.

I must reserve my reply to Saxula's observations respeceing abutments for another number.—Yours, &c.

B. C.

(To be continued.)

P.S.—I forgot to mention, in my former communication, that the practical result which Saxula infers from his theory, is the great advantage which is to be derived from *long cranks*—so long as to reach beyond the obstacle to be surmounted, or the point of the road in contact with the wheel when ascending a hill, which obstacle or point is, he says, the fulcrum, and therefore the power must be placed beyond it.

B. C.

THE REMARKABLE LUMINOUS APPEARANCES ON THE NIGHTS OF THE 14TH AND 15TH DECEMBER, 1830.

Sir,—Your correspondent R. M., from a Market Town in the West of Somersetshire (page 341, No. 388) notices a remarkable luminous appearance on the nights of the 14th and 15th December, 1830, and wishes to know if it was more than local. Of the 14th, I have no memorandum; but of the night of the 15th I have.

I went to London from Birmingham by the Warwick mail that evening; I paid little attention to the light till we passed Banbury; because, though cloudy, I thought it the effect of the moon. But, on passing Banbury, it suddenly occurred to me that the moon was only about two day's old, and therefore could not give any light; after this I paid particular attention to the light, for it became more marked, and I particularly noticed the clearness with which I could discover the trees for several fields off. There appeared none of the ordinary signs of Aurora Borealis, and the light was a generally diffused light; the stars appeared in different parts but faintly, and the greatest part of the sky appeared as if covered with a thin white cloud. I noticed the appearance for several hours through Oxfordshire and Buckinghamshire.

Like R. M., I should be glad to know if it was general, particularly more northward. Unless this appearance be a modification of Aurora, I know not to what cause to attribute it.—Yours, &c.

T. R.

Birmingham, April 8th, 1831.

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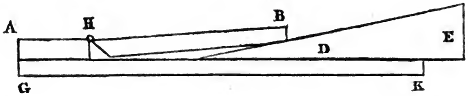
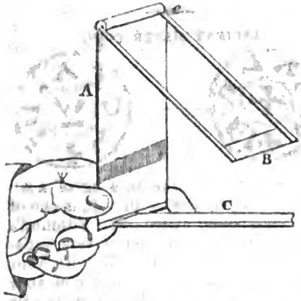
DESCRIPTION OF A SIMPLE AND CORRECT METHOD OF MEASURING A SMALL ANGLE (NOT EXCEEDING ONE DEGREE), BY MR. WILLIAM SHIRES, MATHEMATICAL TUTOR.



The above figure represents the side view of a new instrument which I have contrived for the purpose; its base is a plane, GK, upon which another, AH, is fixed; to which a third plane, HB, is attached by a hinge at H. DE is a thin wedge, made to slide in the direction KG; it follows that the angle AHB, will alter very slowly by the movement of the wedge, DE, so that the side of the wedge and base GK, being divided like the nonius of a quadrant, these divisions will be very large, and thus indicate the smallest alteration in the angle, AHB, with a great degree of correctness. The inventor has put it into practice as a reflecting dynameter, by having two plane reflectors fixed on AH and HB, respectively, and viewing the reflections from them with a telescope of a moderate power; he has thus measured the quantity of an eclipse, the moon's crescent, &c. The wedge may be also applied to the micrometer and dynameter in a telescope: and will be as much more correct than a screw, as it is possible to grind the planes of the wedge more perfect than what the screw can be made. It is necessary to observe, that if the angle were large, it would be described with a motion proportional to the cosines of the arcs described, and not as the arcs themselves; in which case, there could be no index for the correct reading of the observation. Of course the smaller the angle, so much more perfect will equal divisions become; whence in measuring the apparent diameters of primary planets, it will be found an instrument of great perfection. Nevertheless, there may be unthinking persons who will find fault with not being able to divide a line exactly so as to read minutes or seconds of a degree; but let it be divided as they please, and it will be easy afterward to find what number of seconds go to one of the divisions as above mentioned.

W. S.

NOTICE OF A NEW PHOTOMETER, OR SHADOW-METER, CONSTRUCTED BY DR. F. FOX, OF DERBY.



During the discussions which have of late occurred in the neighbourhood of Derby on the important subject of gas-making, it became very desirable to have an easy mode of ascertaining the illuminating power of the gas; and it was to accomplish this purpose that the shadow-meter was planned. A series of highly interesting experiments are now making on the relative light-giving properties of coal-gas, made under various circumstances; and as soon as these results are sufficiently made out, it is intended to lay them before the public, when it will be seen how essential it is in the art of gas-making to observe *constantly* the illuminating power of the gas, that the causes of the *frequent* variations in this respect may be *discovered*, and *obviated*.

The photometers hitherto invented have required too much adjustment for general application. Professor Leslie, of Edinburgh, introduced a modification of his differential thermometer for the purpose of ascertaining the intensity of light, which is extremely apt to get out of order; and many philosophers think it is not a correct index of the degree of illumination, for its action depends upon the heat which accompanies the rays of light.

There is a photometer described in the Transactions of the Society of Arts, by Mr. W. Ritchie, A.M. F.R.S.; in this description it is said to be "*more convenient to have the lights stationary, and to move the photometer, than the reverse; and it is on this latter principle that Mr. Ritchie's photometer is constructed and employed.*" Now, as the shadow-plate is held in one hand, and the weaker light in the other, the shadow-meter is much more expeditiously applied than Mr. Ritchie's photometer.

The shadow-meter accomplishes in a very easy manner what the celebrated Count Rumford performed in his philosophical researches, with the assistance of numerical calculations, founded upon the well-known fact that rays of light emanate in divergent straight lines. When once this instrument has been seen it is easy to imitate it; and to promote its more general adoption, it is requested that the accompanying shadow-meter may be placed with some Society[*] which will be the most likely to extend its application. It may be obtained in Derby, with the following observations:—

"*Dr. F. Fox's Shadow-Meter, Manufactured by S. Smith, 16, Corn Market, Derby.*

"*The Method of using the Shadow-Meter.*—Put the end of the tape round the gas-burner, and fix it there by the hook and eye. Hold the shadow-plate in the left hand so as to keep the tape tight; and having drawn the shadow-rod before the plate, move a well-snuffed lighted candle backwards and forwards along the tape with the right hand, until the shadow of the rod produced by the gas-light, and that produced by the candle on the shadow-plate, are both exactly alike in strength; in order to compare very accurately, press the candle from you against the tape so that the two shadows on the plate touch each other, but do not overlap: this being done, the number on the tape against the candle will indicate how many times the gas-light is stronger than the candle.

"The shadow-meter is equally applicable in all circumstances where a knowledge of the intensity of light is required, for it tells the comparative strength of any two lights, by comparing each separately with the trial candle.

"By finding how much gas is burnt in an hour by a gas-light, and how much wax or tallow is consumed by the trial candle per hour; or of oil in a lamp, the cost of an equal quantity of light from each of these sources is expeditiously discovered. These are very valuable facts, being constantly applicable in this mercantile country.

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[*] The instrument may be seen, for a month after this date, at the Mechanics' Magazine Office, 115, Fleet-street, after which it will be deposited in the museum of the London Mechanics' Institution, Southampton-buildings.

"Dr. Fox is of opinion, that 1000 cubic feet of good coal gas, the selling price of which is 10*s*., will give as much light for an equal time, as 70lbs. of tallow, which at 8*d*. per lb. costs 46*s*. 8*d*.; or 1 cubic foot is equal in illuminating power to about 1oz. 2drs. of tallow; so gas, at this price, is only about one-fifth of the expense of tallow candles. A gas-light, burning 1 cubic foot per hour, should give the light of 3 mould candles nearly,

2 cubic feet of 6 mould candles
3 9
4 12
5 15

"The principle upon which the scale is formed is as follows:—The numbers on the tape are the ratios between the square of the distance of the stronger light, and the squares of the several distances of the weaker light, the number attached to the weaker light always being one. For example—if the square of the distance of the number 12 from the shadow-plate, be compared with the square of the distance of the stronger light from the same plate, the latter will be found to be in the ratio, or proportion to the former of 12 to 1; this is the proportion of the two lights; and so with regard to all the rest of the numbers.

"To enable those to make the instrument who may not have an opportunity of seeing it, the following description is added.

at 30 inches from this plate 16 is marked

31	15
32·16	14
33·4	13
34·8	12
36·27	11
37·97	10
39 9	9
42·4	8
45·37	7
48·85	6
53·6	5
60·	4
69·17	3
85·07	2

at 120, or 10 feet, a line is made across the tape, at which place it is fixed to the stronger light."

Description of the Engraving.

The Editor has, for the better elucidation of the preceding communication from Dr. Fox, prefixed a slight sketch of this very simple but ingenious and most efficient contrivance. A is the shadow-plate, 4 inches long by $2\frac{1}{12}$ broad, made of tin, painted white; B, the shadow-rod or frame, which turns on a hinge *c*; C, part of the index-tape.

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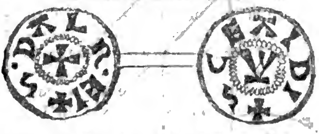
ANCIENT SILVER COIN.



Sir,—I send you the drawing of a silver coin I lately met with. It is one of those commonly called St. Edmund's pennies; but I cannot learn very satisfactorily its history. I wish, with your leave, to submit it to the notice of your numismatic readers. Ruding places its date at a period not much subsequent to 1097, and supposes it to have been issued from the Abbot's mint.—Yours, &c.

A.

◆

ON THE PENDULUM, AS APPLICABLE TO DETERMINE THE LATITUDE.

Sir,—In the Mechanics' Magazine for November, the Pendulum was considered relatively to the local gravities of the earth. If the assumption was there correctly stated, that similar pendulums of unequal lengths would, under like conditions, vibrate through equal arcs of a circle, the application of this instrument to various purposes becomes more simple and effective. The truth of that statement being granted, the results of experiments will not be affected by the temperature of climates.

The pendulum being suspended from an axis to revolve in the centre of a circle, and resting in a natural state of quiescence, may have the lower end raised through an arc of ninety degrees, and be allowed to make one complete vibration. During the movement, it will pass a vertical line V, which intersects the axis in the middle; and it will rise on the other side through a second arc to some point of elevation at a distance from V. Let that point be marked on a hemispherical arc, which has been prepared for the purpose; and let the latitude, in which the experiment has been made, be denoted in connection with that point. In all latitudes more approximate to the poles, the pendulum will never, under the same conditions, rise as high as that point; and in all latitudes more approximate to the equator, it will always rise higher.

If accurate experiments be made in latitudes of eight degrees distant from each other, a regular series of intermediate latitudinal points may be completed; and the pendulum rising to any one of those points will, by the latitudinal degree in connection, indicate the latitude in which the vibration has been made. It is probable that the distance between any two contiguous points will be greater in the equatorial regions, and less in advancing towards the poles.

If one of these instruments was accurately constructed, copies might be multiplied; and these would be useful to mariners under those adverse circumstances that render astronomical observations impracticable.

The measure of relative gravities is to be most truly found by the last division of an arc, described by the first single vibration; but gravity is not in the present inquiry a subject of investigation.

In determining the latitude, it will be found more convenient that the pendulum shall complete two vibrations; and be allowed to return towards the primitive elevation of ninety degrees, from which the oscillations commenced. The differences of the rise in different latitudes will then become much greater, be more perceptible, and will admit of observations being more correctly made.

If the latitudinal points were to occupy spaces equally distant from each other, they might be arranged by calculation; but it is supposed that the first series can only have their localities satisfactorily assigned by actual experiments, scientifically effected.

Degrees of latitude, although they may be traced on an arc of a circle, will be essentially different from degrees of the circle itself.—Yours, &c.

N. V.

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WHEEL-WORK PROPORTIONS—ANSWER TO INQUIRY.

Sir,—I have just received Nos. 398, 399, and 400 of your Magazine, with the Appendix to Vol. XIV; and, in replying to S. J. Dryden, at page 62, I have to observe that the centres of the two wheels being fixed 2·1 inches asunder, the sum of the diameters of both wheels at their pitch circles is of course 4·2 inches, so that the sum of their circumference is 13·2 inches, very near; and the pitch being ·22 inch, gives 60 teeth in both wheels. As the wheels are to revolve in the ratio of 90 to 150, and these two terms together make 240, which is just four times greater than the number of teeth in both wheels, it follows that the number of teeth in each wheel is one-fourth of each of those terms of the ratio, inversely, viz. 37½ teeth in one wheel, and 22½ teeth in the other. But as half teeth are impracticable in wheel work, Mr. D. will perceive the unavoidable necessity of having either a different pitch, or some difference in the ratio of the revolutions of the two wheels.

The diameters at the pitch circles of wheels which work into each other, are directly as their number of teeth, and inversely as their number of revolutions; therefore, 240:150::4·2:2·625 and 240:90::4·2:1·575; whence it appears, that if the revolutions of the wheels be 90 and 150, or 3 to 5, the diameter of one wheel must be 2·625 inches, and the other 1·575 inch at their pitch circles; and as the curved part or ends of the teeth project beyond those circles, say one fourth part of the pitch, thereby adding ·055 inch to the radius at ·11 inch to the diameter of each wheel, it follows that if half teeth could be admitted, the outside diameter of the largest wheel would be 2·735, and that of the smallest 1·685; but, as I observed before, either the pitch or the ratio of the revolutions of the wheels must inevitably be different.

If the ratio of the revolutions must needs remain 3 to 5, then the nearest whole numbers for the teeth, for occasioning the least possible difference in the pitch, are either 21 and 35, or 24 and 40—the former being the product of the above terms multipled by 7, and the latter by 8; the pitch in the one case being rather greater than ·22 inch, and in the other case somewhat less.

The lateness of my reply makes it proper to state, that I attended to Mr. D.'s communication immediately on receiving the No. containing it: but as the Mechanics' Magazines are not sent very regularly to your publishers at Hull, of whom I receive them, there almost always remains some numbers in arrear, whence it happens that my communications cannot be otherwise than late.

Yours, &c. J. H.

Barton-upon-Humber, April 16th, 1831.

MR. GURNEY'S STEAM CARRIAGES.

Letter from John Herapath, Esq. to the Editor of the Times.

"Sir,—When, three years ago, the experiments of Mr. Gurney had excited considerable interest, and I was called on to deliver my opinion publicly as to the practicability of applying steam to propelling carriages on the common roads, there was scarcely a scientific man besides, in the kingdom who did not thoroughly ridicule the idea. One asserted that a steam-carriage would not ascend a hill; another, that it could never exceed five, six, or seven miles an hour; a third, that it could not go out of a straight line; and a fourth roundly declared it would never run at all on a common road. However, as soon as I had examined the principles, I at once saw the feasibility of the undertaking, and hesitated not to publish my sentiments thereon, computing several particulars relative to the power, manageability, &c. of steam-carriages. These were more fully developed, and other curious properties of such machines added, in a pamphlet afterwards addressed to the Duke of Wellington, on the Utility, National Importance, &c. of Mr. Gurney's Steam-Carriage; all of which have been amply verified by experiments since; some, indeed, so late as a month ago. But a proof is now before the public within the comprehension of every one. These carriages, as your readers know, have been running daily between Cheltenham and Gloucester, for six weeks past. The distance, nine miles, they frequently accomplish with 10 or 12 passengers in 40 minutes, averaging 13½ miles per hour, and gaining, in the language of commerce, 50 per cent. in speed on the Cheltenham mail, which I understand takes one hour to travel the same ground. By a late arrangement, Sir Charles Dance, who resides in the neighbourhood, informs me a stage-coach is attached to the steamer; thus affording three several grades of conveyance, according to the means or tastes of the passengers—inside and outside places with the attached coach, and a covered place on the steam-carriage. Twenty-two persons instead of 12 are by this means conveyed by one machine; and it has been found that attaching 26cwt. thus to the loaded steamer retards it only about four minutes in the nine miles.

"For a first essay this pretty well demonstrates the practicability and importance of the invention. So satisfactory, indeed, is it, that the parties intend soon to run between Birmingham and Bristol, and in other parts of the kingdom. One, a very light and elegant carriage, has been sent off to Edinburgh for the purpose of commencing between that city and Glasgow. Hence are we about to witness this long-expected desideratum in mechanics reduced to general practice, and I hope destined to feel its beneficial effects.

"With the last carriage Mr. Gurney and myself tried some experiments a short time since, for the purpose of ascertaining the powers of an improved backing-apparatus, and satisfying some other points connected with the manageability, &c. of the carriage. We first tried the effect of cutting off the steam and leaving the friction to act alone. By several trials the carriage stopped in from 5 to 6 seconds, going down Albany-street, and in from 4 to 5 going up, loaded, and running at the rate of 11 miles per hour.* It would hence appear that the friction of this road is 1-9th instead of the average 1-12th, which confirms Mr. Gurney's previous observations to me, that he had always found this a heavy piece of road. Afterwards many experiments were made with the backing-apparatus. The results were, that the carriage, going at the same rate and with the same load, was arrested in 2 seconds; and in 2 seconds more made to back with an equal velocity. Nothing could more decisively illustrate the utility of this contrivance for the prevention of accidents, or the power of retreating from difficulty and danger, than this part of the experiments. Indeed, so beautiful was the action of the backing-apparatus, that I could not help wishing for the presence of some of the before-mentioned scientific sceptics. Had they seen this machine in the midst of full speed, and without any apparent cause or effort, stopped and instantly made to run backwards with equal rapidity; in one moment threatening some carriage with instant collision, and in the next dexterously avoiding the contact, by changing its course or stopping, and retreating, together with numberless other manœuvres, I should not have been surprised to hear them exclaiming with the countryman who saw one of these carriages in motion—"Really, I cannot believe but Gurney must have dealings with the devil."

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* If R be the retarding force, resistance or friction in parts of the weight; V the velocity in miles per hour; and T the time in seconds in which the body would be reduced to rest by the friction alone, $V = 22\,RT$ is a theorem from which the velocity, friction, or time may be found, by knowing the other two either on a rail or common road. Hence the utility of this theorem in the determination of several interesting matters in the action of steam-carriages.

"Improvements in the construction of steam-carriages will, of course, continually arise; and I doubt not but 12 months' experience on the roads will still add much to their present simplicity and power.

"Even since my last communication, considerable alterations have been made. Instead of the steamer being merely a dragging-machine to another carriage, it has now, as I have long wished to see, a tasteful body for passengers on the same wheels, without, however, abandoning the principle of towing. The heat of the boiler is cut off by a very simple contrivance, except a little to render the carriage more comfortable in winter, but which is insensible in summer. The "pincers" invented to keep the carriage steady to its course, and the "shoe-drags" to stop it at pleasure, not being found so needful as was expected, are replaced by a simple improved backing-apparatus, with which the machine, by a single motion of the foot, is not merely arrested, as I have stated, in a second or two, but made to avoid accident promptly, or retreat from danger with any velocity. Important improvements in the boiler, for the augmentation of power, have likewise been made, and one in particular for cleaning it mechanically, as well, as heretofore, chymically. Formerly the tank for carrying the water was one in front of the steamer; now it is divided into two considerably larger, and commodiously packed out of sight, under the seats of the passengers. By this means two advantages are obtained—by the one, the power is increased by throwing a greater weight on the hind or working-wheels; and by the other, the carriage is enabled to run for a longer time, and, consequently, a greater distance, without renewing its water. Appearance has also not been overlooked. The machinery is more tastefully fitted up, and the inelegant bars of iron, called "carriers," are removed from the outside to the inside of the hind-wheels, thus adding to the strength as well as beauty of the carriage. On the whole, there is now wanting the disappearance of one object—the chimney, which is, however, by no means unsightly, and may easily be enclosed—to make this carriage as elegant and beautiful, according to modern ideas, as it is powerful and useful.

"I cannot here help mentioningone fact relative to this invention, and the much-boasted application on rail-roads. We are told that the latter carriages have run 30 or 35 miles per hour. Now the friction on rail-roads is at a medium about a twentieth of that on common roads. If so, Mr. Gurney's carriages, which at Cheltenham are carrying full loads 13 or 14 miles per hour, would transfer the same weight, not 30 or 35, but 20 times 13 or 14, that is, 260 or 280 miles per hour on a railway, supposing mechanical laws followed, and that the materials and resistance of the atmosphere would allow it.

"Now these carriages are about to become public property; I must beg to allude to another circumstance, which I presume, when generally known, will be admitted to be no less impolitic than unjust. Round the neighbourhood of London the turnpike directors have had a clause introduced into their acts, I am informed, for levying a toll on locomotives of 1s. per carriage. In my pamphlet before alluded to, I have shown, from experimental facts, that one of these machines wears the roads only one-seventh as much as a stage coach and four horses. The toll of such coaches I think is usually 10d., whereas if made in proportion to the impost intended to be levied on steam carriages, it should be no less than 7s. per gate! Why, then, I would ask, is so disproportioned a tax to be laid on inventive genius, and of course on the community, in opposition to justice, common sense, and the expressed declaration of the present Ministry?—and on an invention, too, in its very infancy, which the best informed of the country, as well as the late Premier, conceive to be of national importance? Why, I repeat, is genius in this way to be bruised in the bud, and the beneficent branches of invention thus to be lopped and mangled, to the injury of the public, for private advantage? If mental as well as personal wealth must be taxed, let our country—that is, our Government—reap the benefit; not individuals (I mean nothing personal) who can have no right to it. I, for one, should not object to a Parliamentary impost on steam carriages, and, I believe, the parties concerned would not, so that it be laid on with reason and moderation. But to rate, with one sweeping sum, machines, which may as easily be made to carry 100 tons as one ton, without any regard to weight or the wear of the roads, is really a strange method of proceeding.

"Instead of taxing steamers so unequally, would not the turnpike authorities do much better to improve their roads for the introduction of these machines? Sir Charles Dance has informed me that he has a plan for improving the common roads which would be of the first consequence to steam-carriages, and of great service publicly. Let this or some other plan for bettering the roads be adopted, and though the toll be so very unfair, it will nevertheless be cheerfully submitted to; but to leave the "metropolitan roads" as they are—about the worst running roads in the kingdom—and yet to tax locomotives 600 per cent. more than they ought to be, is carrying the principle of private taxation a little too far: it is not the way certainly to let the metropolis derive much advantage from the invention. But probably this excessive toll was the effect of bad information, or ignorance of the subject; if so, I have no doubt it will be immediately inquired into and altered.—Yours, &c.

"JOHN HERAPATH.

"*Cranford, April 6.*"

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TRACING AND TRANSFERRING PAPERS.

There has been imported from France of late years, sheets of a thin transparent substance, which have been found by artists to be greatly preferable to any tracing-paper hitherto employed by them. The substance is evidently a preparation of gelatine—most probably bone glue. It goes in this country by the name of French glass-paper. Mr. W. Kelsall, engraver, employs this paper to make tracings, in the following manner:—He places it upon the original design which he wishes to copy and transfer, and with a fine etching-needle copies the outlines of his subject on the surface of the glass-paper. This done, he rubs over it some patent calomel, which enters into and fills up the lines so drawn; the remainder he carefully removes. He then places the surface of the glass-paper thus treated in contact with the etching-ground of his copper-plate, and secures it from slipping; and next by slight blows, dextrously applied, transfers the calomel to the etching-ground.

Mr. Gill, the ingenious Editor of the Technical Repository, from which work we have taken this account of Mr. Kelsall's method, points out the following equally effective and still cheaper means of procuring similar results:—

"Many years since, a person submitted to the Society of Arts a method of drawing perspective representations of objects and of transmitting them to the surface of paper. His method consisted in coating the surface of a piece of plate-glass with a solution of gum arabic, and letting it become dry. This glass he then mounted perpendicularly, by placing it in a groove made to receive it in a wooden basis, and which also carried a sliding-arm that supported a metal plate, having a small orifice in its centre to serve as an eye-piece. The outlines of any object were then to be traced upon the gummed surface of the upright glass with a fine needle fixed in a proper handle; the eye of the artist being at the same time applied to the orifice in the eye-piece; and thus a perspective outline of the object might be readily drawn in the thin coat of gum. The glass-plate being removed from its stand, the lines traced in the gummed surface were then to be filled with copper-plate printing-ink, which was wiped off the surface as usual. A moistened paper being then laid upon the inked surface, the outlines might be transferred therefrom to the paper by burnishing the back of it with any proper and smooth instrument.

"The Editor put this method to the proof, and thus obtained the outlines of the object he drew upon the gummed surface of the glass transferred upon the paper. The success of the experiment was not, however, sufficient to merit the reward of the Society.

"Now, he would suggest, that a thin plate of glass, coated either with a solution of gum arabic, or with a mixture of gum arabic and isinglass, might be substituted for the French glass-paper with every prospect of success; and the outlines of any object traced upon it might be filled with calomel, be reversed, and transferred to the surface of the etching-ground in the manner done by Mr. Kelsall. Doing the glass over with a fresh coat of gum would render it again fit for service.

"We also think that a thin plate of lantern-horn might be conveniently employed as a substitute for the French glass-paper, and at a much cheaper rate; although it would not possess the great advantage of the capability of being used repeatedly, which the prepared glass-plates do."

EIGHT-WHEELED COACHES.

About the end of last century, there were several stage coaches constructed with eight wheels. Two plied for some time between Bath and Bristol, and they were so constructed that each wheel supported its share of the load, carrying its proportion, and no more, over every obstruction; the consequence was, that when a wheel passed over a stone two inches high, the middle part of the carriage rising only an eighth part of two inches, or one quarter of an inch, they were, perhaps, the easiest coaches to passengers that were ever sat in. There is now (1820) living in Bristol, a man who constantly drove one of these coaches. He informs me, they carried 14 inside and 16 outside passengers, besides baggage. With this enormous load, he used to go between the two cities, twelve miles of road, at that time much more hilly and in worse condition than at present, with four indifferent horses, in two hours. I understand the reason why these coaches were discontinued was, that, as they carried at a low price they were often filled with a crowd of mean people, which disgusted the more respectable travellers, to whom alone the proprietors could look for permanent custom; the coaches, of course, dropped. This, however, does not affect their principle as machines; on the contrary, the report of them tends greatly to confirm the theory I have attempted to establish (that the greater the number of wheels, among which a weight is distributed, the easier will be the draught).—*Essay on Wheel Carriages, by Joseph Storrs Fry.*

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TEMPERATURE OF THE INTERIOR OF THE EARTH.

The circumstance of the Earth's being flattened at the poles, and protuberant at the equator, is the natural and necessary result of its rotation on its axis. But, in order that it might yield to the force resulting from such a motion, the matter of which it is composed must have been soft. Now, although water is capable of being compressed, and as far as we can judge, of taking any degree of density, according to the force exerted upon it, still the shape of the earth is not that which would have resulted from such a mass of *water.*—There may be particular portions of the sea that extend to the depth of several miles, as there are particular points of the solid crust of continents that rise to this height above the general level. Still we have reason to believe, that the average depth of the ocean does not much exceed 3,000 feet. It is thought, that heat may have been the original cause of the fluidity of the earth, and that there may still remain enough to keep the interior portions in the same state. The more this subject has been examined, the more the evidence has accumulated in favour of the position, that the temperature increases as we descend below the surface. There are numerous instances in which we have been able, by means of natural or artificial excavations, to penetrate to the depth of from 1300 to 1600 feet. The general inference, from all the observations made in different parts of the earth is, that there is an increase of heat amounting to about 1° Fahr. for every 46 feet in depth; that at the depth of 10,000 feet, the heat would be sufficient to boil water: and, that at the depth of about 100 miles, or $\frac{1}{40}$ part of the distance to the centre, the heat would be intense enough to melt most of the earths and stones that are known to enter into the composition of the globe. These facts and inferences have an important bearing upon the phenomena of earthquakes and volcanoes, and open a wide field of speculation to the natural historian and geologist.—*American Almanac.*

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NEW TANNING MATERIAL.

A physician of Narbonne has discovered that the husk of the grape, after being deprived of its alcohol by distillation, may be employed as a substitute for oak bark in tanning leather. The employment of this substitute offers the following advantages. 1. It does the business in less time, from thirty-five to forty-five hours being sufficient. 2. It is cheaper than oak bark. 3. It imparts to the leather an agreeable odour. And, 4. Leather thus prepared is said to last twice as long as that made with oak bark. —*Recueil Industriel.*

CHINESE SECRET IN DYEING.

The Chinese never attempt to dye any fine silks with rich colours till the north-east monsoon, called by them Pak Fung, sets in, which it generally does about the end of September, when the air becomes so excessively dry, that floors of wood, not sufficiently seasoned, have been known to open an inch at least. This attention to the state of the atmosphere constitutes the whole secret of the great brightness and durability of the Chinese colours.

PREJUDICE AGAINST INNOVATORS.

"I was the first person who attempted the use of mules—certainly in the Southern States, if not in the United States—for the purpose of agriculture. I was ridiculed by old and young: but I have lived to see the only limit to their use is the circumstances of the planter. I was the first to attempt to dam out the inundations of the Pee Dee, and consequent thereon had well nigh been deprived of a seat in Congress, because it was thought any man who believed he could keep the fresh from his low grounds was too big a fool to go to Congress. Now, there is nearly as much swamp land reclaimed from freshets in South Carolina as on the Mississipi."—*Mr. D. R. Williams—Franklin Journal.*

LIST OF NEW PATENTS GRANTED FROM 21ST OF MARCH TO THE 21ST OF APRIL, 1831.

Thomas Brunton, of Park-square, Regent's-park, Esq., for an improvement in certain apparatus, rendering the same applicable to distilling, communicated to him by a certain foreigner residing abroad. Six months, to specify, 28th March, 1831.

Thomas Coleman, of St. Alban's, training groom, for an improved roller for horses. Six months, 29th March, 1831.

Andrew Ure, of Finsbury-circus, M.D., for an improved apparatus for distilling. Six months, 31st March, 1831.

John Wallace, of Leith, brazier, for an improvement or improvements upon the safety-hearth, for the use of vessels. Six months, 31st March, 1831.

James Slater, of Salford, bleacher, for certain improvements in the method of generating steam or vapour applicable as a moving power, and to arts and manufactures; and also for improvements in vessels, or machinery employed for that purpose.—Six months, 2nd April, 1831.

William Rutherford, Jun., of Jedburgh, writer and bank-agent, for a combination or arrangement of apparatus or mechanism to be used by itself, or applied to locks and other fastenings, for more effectually protecting property. Six months, 14th April, 1831.

Samuel Morand, of Manchester, merchant, for an improved stretching-machine. Six months, 14th April, 1831.

Thomas Brunton, of Park-square, Regent's-park, Esq., for an improvement in certain apparatus, rendering the same applicable to steam-engines; communicated to him by a certain foreigner residing abroad. Six months, 14th April, 1831.

Thomas Brunton, of Park-square, Regent's-park, Esq., for an improvement in certain apparatus, rendering the same applicable for making or refining sugar; communicated to him by a certain foreigner residing abroad. Six months, 14th April, 1831.

Thomas Gaunt, of Chapman-street, Islington, gentleman, and George Frederick Eckstein, of Holborn, stove and grate manufacturer, for an improved fire-grate. Six months, 14th April, 1831.

MINOR CORRESPONDENCE.

Water-Pipes.—Sir,—In No. 341, Mr. Baddelev makes somes remarks with respect to the plumber's harvest, as he calls it. I am of his opinion on that head; but I want to know from Mr. B., whether it is the frost, or the force of water after the frost, which bursts the lead pipes? He has not explained this to my satisfaction. As to the ferules, the old sort are not the right sort for cast-iron; I saw a *screw* ferule some time back, at Mr. Smith's glass warehouse, Great Castle-street, Regent-street.—Yours, &c., AN INQUIRER AFTER PRACTICAL KNOWLEDGE.

Smoke Jacks.—Sir,—Allow me to request you, or any of your readers, will have the goodness to inform me, whether there is such a thing as a smoke-jack with a vertical, instead of a horizontal fly, in the chimney, and where one may be seen or procured.—Yours, &c., A CONSTANT READER.—*April* 13, 1831.

Comparative Economy of Planting in Horisonta and Diagonal Lines.—Sir,—In the communication on this subject, inserted in your number of this day, there is a slight omission in the diagonal lined figure, which renders the description, in some parts, not explanatory of the figure. There should have been a faint or dotted line from B to D, passing through the points *f* and *a*. The point where it intersects the line AC, I have called *e* throughout my letter. I make it a faint line, because it is necessary only in the proof of the thing, which is scarcely clear enough without it. There is also a slight mistake in the following sentence:—"From the nature of the figure, all these lines will form a series in arithmetical proportion, of which the first, *y z*, is unknown, and the last, *a . z*, known=7·0710677 feet." Instead of *a z* it should have been A.C, the hypothenuse.—Yours, &c., S. B.—*London, April* 9, 1831.

Iron Bridges.—Sir,—Through the medium of your very useful Magazine, I wish to stop the dissemination of a falsehood, respecting the invention of iron bridges. Carlile, in his Life of Tom Paine, says, "In the year 1787 Mr. Paine returned to Europe, and first proceeded to Paris, where he obtained considerable applause by a model of an iron bridge, which he presented to the Academy of Sciences. The iron bridge is now becoming in general use, in almost all new erections, and will doubtless, in a few years, supersede the more tedious and expensive method of building bridges with stone; how few are those who walk across the bridge of Vauxhall, and call to mind that Thomas Paine was the first to suggest and recommend the use of the iron bridge!" Now, Mr. Editor, in the year 1779, there was an iron bridge erected over the River Severn, near Broseley in Shropshire; which period, unfortunately for Mr. Carlile, happens to be *full eight years* prior to Mr. Paine's exhibition of his model in Paris.—Yours, &c. AN OLD TINKER, *April 6th*, 1831.

The Patent Tuning-Tube.—Sir, Seeing in No. 400, a very neat suggestion for an improvement in the flute, I beg leave to submit the following to the notice of your readers. Allowing the excellence of the patent tube for tuning the instrument as it exists at present, would it not be better if this were constructed with a screw instead of a slide? The advantage arising from this would be in the increased steadiness of this part of the instrument; the disadvantage only in the additional weight of metal, which would be comparatively very trifling. Further, would not the screw be also advantageous in the other joints of the instrument?—Yours, &c. TIBIA.

Cast-Iron Gutters are recommended in the Mechanics' Magazine by a Son of "Vulcan;" and he tells us that the frequent cause of fire arises from "the necessity of repairing lead gutters, which requires the use of braziers on the roof." He further informs us, that "it was in this way old Drury Lane Theatre is supposed to have caught fire." Now, Sir, I am an old tinker, but I never knew braziers employed to do plumbers' work. I hope when "Vulcan" sends to you again, that he will write something more to the purpose.—Yours, &c. AN OLD TINKER, *April* 6, 1831.

Poetical Quotation Reclaimed.—Sir, Dr. Isaac Watts, in his Improvement of the Mind, part I. chap. iv. quotes from Virgil the well-known line—

"Fas est, et ab hoste doceri;"

and, in his impressive manner, thus paraphrases the idea of the Latin poet:—

"Seize upon truth, where'er 'tis found,
Amongst your friends, amongst your foes,
On Christian or on Heathen ground;
The flower's divine where'er it grows:
Neglect the prickles, and assume the rose."

Dr. Watts was born 1674, and died 1748; and Wesley was born 1703, and died 1791. I have been induced to forward the above, in consequence of the *Note* which appears at p. 112, Mechanics' Magazine.—Yours, &c. WILLIAM BECK, *Spitalfield's Mechanics' Institution, April* 19, 1831.

[A note to the above effect has also been received from Nemo, jun.]

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MISCELLANEOUS.

Euler.—This celebrated mathematician, before his death, expressed a wish that, for each forty consecutive years after his decease, the Memoirs of the St. Petersburgh Academy of Sciences should contain a portion of his posthumous papers. This request has been most religiously complied with, the forty years having terminated in 1823. But there still remain fourteen more dissertations of Euler's, which are now published in the eleventh volume of the Memoirs of the Academy.—*Monthly Review.*

Comparative Wealth.—Mr. Albert Gallatin, the Secretary of the American Treasury, in a pamphlet which he has lately published on the Currency, gives the following comparative estimates of the amount of specie and paper possessed by different countries:—Russia, four dollars per head; the United States, six dollars; France, from thirteen and a half to fifteen dollars; Great Britain and Ireland, fourteen dollars. Total currency of Europe and America, from two thousand to two thousand three hundred millions of dollars, of which three-fourths are metal and the remaining fourth banks' notes, payable on demand, and Government paper, redeemable at the option of the issuers.

Colours from Potatoe Flowers.—A Scotch Paper has erroneously ascribed to Lord St. Clair (Sir John Sinclair) the discovery of a beautiful colour extracted from the flower of the potatoe. It is long since the French scavans were aware of the possibility of applying the liquor of the potatoe, and also the flowers of that plant, to the art of dyeing. M. Fouques has shown, by experiments made with Cadet de Vaux, that thread and cottons plunged in potatoe liquor took a grey colour; and in 1817, a chemist of Copenhagen pointed out, in a scientific journal, a simple method of obtaining with the flowers of the *solanum tuberosum* a beautiful yellow colour. He has dyed in this manner linen, cotton, and even woollen cloths, which took a strong green colour by immersion in a blue tincture.—*Recueil Industriel*

Quackery no Novelty.—The collyrium of Danaus was sold at Constantinople for 120 numismata, and the colical antidote of Nicostratus for 2 talents; in short, we find an unbounded credulity with respect to the powers of most medicines, from the elixir and alkahest of Paracelsus and Van Helmont to the tar-water of Bishop Berkeley, the metallic tractors of Perkins, and the animal magnetism of Messrs. Prescott.—*Dr. Paris.*

Phosphorus-Match Light.—The following receipt was for some time the subject of a patent possessed by M. Derepas, of Paris:—Into a large flask, heated in a sand bath, put eight parts of pure phosphorus; which you are to half melt, without allowing it to oxidize. Add four equal parts of magnesia; begin to mix the whole at a heat of 234·5° Fahr.; reduce the heat gradually to 106·25°, and in about an hour you will have a fatty powder, which is to be put into bottles, and when cold, carefully stopped. This substance will instantly inflame a common match.

Artificial Ears and Eyes.—Signor Vorlez, of Florence, when a very old man, in the beginning of the last century, was the original inventor of the artificial ear; he also constructed an artificial eye: both of which were highly creditable to his talents.—*Curtis on the Ear.*

Military Acoustics.—The Spanish soldiers were, it seems, formerly practically acquainted with acoustics; for we read, that by means of a long ear-trumpet placed on the ground they were accustomed to listen to the conversation of the enemy's sentinels placed at a great distance from them.—*Ibid.*

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INTERIM NOTICES.

Volume XIV. may be now had complete in boards, embellished with a large engraved sheet of Autographical Memoirs of eminent Men of Science, Engineers, and Mechanics of the Nineteenth Century.

Communications received from Mr. N. White—R. J.—Marmor—S. B. P.—Hezron—W. T. H—A Subscriber to the Railways—Mr. Plymsell—Mr. Hughes—A Believer in Perpetual Motion.

LONDON. Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

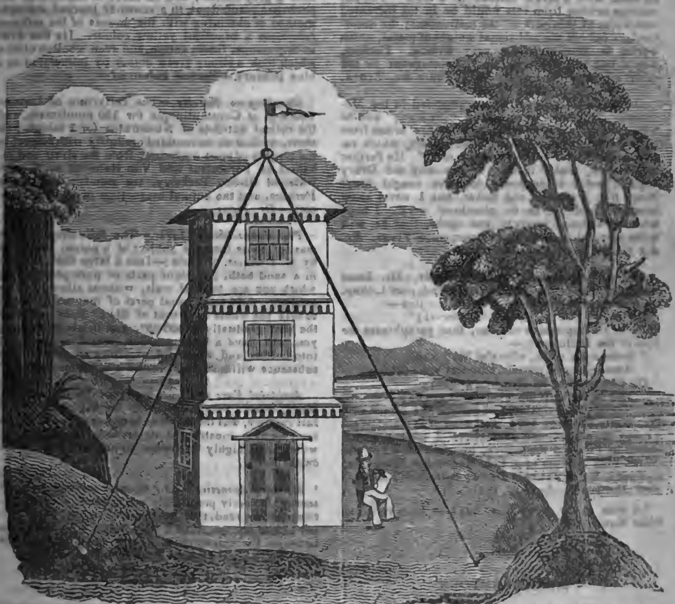
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 403.] SATURDAY, APRIL 30, 1831. [Price 3*d*.

AN ITINERANT OBSERVATORY, OR PLEASURE HOUSE.



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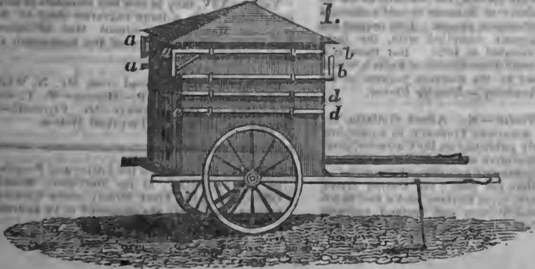

AN ITINERANT OBSERVATORY, OR PLEASURE HOUSE.

Sir,—An expedition before setting out to explore the interior of a strange country, ought to be provided with every possible convenience, but such especially as may tend to forward the primary object of the undertaking. It occurs to me, that on occasions of this nature it would be beneficial to have a house transportable on a mere carriage-frame or kind of dray, and capable, when placed on the ground, of being raised to a height of from 25 to 30 feet, containing three separate apartments, one above the other, and having an internal communication by one or more short ladders. It might, likewise, be serviceable in another way. In the domains of most of our nobility and gentry there are favourite spots commanding interesting views of the surrounding country, placed upon which, such a house as we are speaking of, would be at once an ornament and a pleasant resort for visitors during the summer. Its being so portable a vehicle would also be a great recommendation, for it might be carried to places on which it would be highly dangerous to have a fixed building, and in severe weather it might be preserved under the cover of some shed.

The principle on which I should propose to construct this carriageable-house, would be the well-known one of the sliding tubes used for telescopes and other optical instruments. As seen in the prefixed engraving, its elevation would much resemble the Chinese Pagoda, so universally admired for ornamental effect. A few words may be necessary in further explanation of the engraving. It will be observed, that the apartments are three in number, decreasing upwards; the lower one supposed about the size of an ordinary caravan, capable of containing the two lesser ones, in which state it is shown in fig. 1, packed up and placed on wheels; the roof forming a perfect shelter for the whole, without any appearance of the projecting eaves seen in the elevation. At the sides of the carriage hang the 8 poles, *ab*, *cd*; four in the form of a crane, and the remainder straight. The first set, *a b*, are for screwing into the corners of the ground-floor apartment, to sustain the weight of the upper rooms; and the second kind, *c d*, are used for the same reason as a stay to the floor above. To prevent the rain from entering at the joinings, the smaller rooms have a broad band of waterproof canvass, nailed on the outside round the lower edge, in such a way, that it may turn up against the side when the rooms are to be lowered into each other. To add to the firmness of the structure, it might have a pole passing through the centres of the two apartments, and as the bottom one need not be boarded, it could easily be made secure in the ground; or with or without this, cords might be used, as in fitting up a tent, stretching from the roof to stakes driven well into the earth. This contrivance might doubtless be altogether much improved upon, the present being but a crude suggestion; but this I leave to the ingenuity of more skilful artists than myself: all I shall add, in conclusion, is, that what may perhaps appear the greatest difficulty in practice, namely, to raise the rooms the one above the other, would require little else than the common pulley worked by 3 or 4 hands to effect. The two upper rooms would be first hoisted up together, and made to rest on 4 pillars, as *a b*. Next, the lesser room would have to be raised and secured after the same manner, by the straight pillars *c d*, fastened into the corners of the middle chamber.

Among some of the uses to which houses of this description might be usefully applied, it is not unreasonable to suppose, it would be of service in taking views of low flat country where a prospect could not otherwise be obtained; and in travelling, its advantages might consist in elevating its inmates above marshy land, and, when removed, it could be used to carry baggage, in addition to all its own furniture.—Yours, &c.

HENRY D——.

Liverpool, March, 1831.

◆

SIR JOHN SINCLAIR'S CORRESPONDENCE.*

It has lately become the fashion for a man to do many things in his lifetime which formerly he would have left for his heirs, executors, administrators, or assigns, to do after him: thus we have had collectors of books, antiquities, and pictures, who, in the last century, would as soon have thought of parting with their dearly-acquired and much-prized museums or libraries before the breath was out of their body, as of navigating the Thames against wind and tide, now calling a sale of their curiosities with as much indifference as a professional vender of them. This mania for doing in time present, what used to be left for "time and the curious," would seem to be extending to the publication of correspondences, if we are to judge from the two well-got up volumes before us. It used to be reckoned indelicate to publish the memoirs or correspondence of any habitant of this breathing world; but the worthy agricultural and factotum Baronet has led the van in the attack on this old custom, and boldly ventured into the field in his own proper person—"alive and hearty." Perhaps this is as well as the old way; and we care not if the example be followed as generally as that of the curiosity-collectors aforesaid.

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* The Correspondence of Sir John Sinclair, Bart. with various Eminent Characters, &c. London: Colburn and Bentley. 2 vols. 8vo. 1831.

Every body must, somehow or other, have heard of Sir John Sinclair—he has been so often before the public in one shape or other, generally with some hopeful scheme for the eradication of Poverty in these islands, or paying off the National Debt in a twinkling, that he is usually set down for a well-meaning, but not very profound, "active"—Scotch Baronet. He opens his book with an opinion of a certain Abbé, who was one of his ten thousand correspondents, that he, the said Sir John, is the man of the greatest acquaintance in Europe—and follows it up by a short sketch of his "birth, parentage, and education, life, character, and behaviour;" and an enumeration of *a few* of the great acquaintance alluded to. It must be admitted that these lists are rather *imposing*, inasmuch as they comprise, along with a multitudinous array of wool-growers and hog-feeders, a very numerous assortment of the Kings and Statesmen who have figured on the stage in Sir John's lifetime—no less than seventy-seven years. Many of these, however, occupy nearly as much space in the Index as in the body of the book, although no small knowledge of the useful art of book-making is displayed in the getting up. For instance, one of these illustrious letter-writers is the late Lord Castlereagh: after giving a sketch of his Lordship's career, (one way of eking out a work) we come to the *only* specimen of his epistolary powers with which Sir John has favoured us—simply because it is the only one with which he ever favoured Sir John. Mark with what extreme accuracy, and with what due attention to etiquette, the important communication is ushered in:—

"Letter from Lord Castlereagh to the Right Hon. Sir John Sinclair, Bart.

"*St. James's Square, 4th July*, 1813.

"My dear Sir,

"I have to acknowledge your letter, and the note accompanying it, of the 29th of last month; and must beg to refer you to my Lord Liverpool on the subject to which it relates; it being a matter more for his Lordship than myself to consider and determine upon.—I have the honour to be, my dear Sir, your most obedient humble servant,

"CASTLEREAGH.

"Sir John Sinclair, Bart."

There are many more such every-day notes as these, of no use to any one but the owner; and which only serve to give the *barkers* of literary ware an opportunity of vaunting as to the vast extent and variety of Sir John's noble connexions.

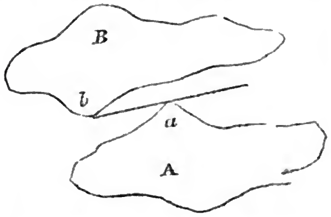
Lord Castlereagh does not come in for much praise from Sir John, for no other reason, apparently, than that he was no very ardent admirer of the Baronet's. The degree of warmth or coldness with which any Minister listened to his plans, seems to have been the key to his opinion of him. Thus, Pitt, who at one time mightily affronted him by neglect, and at another set him on his favourite hobby—the Board of Agriculture—is spoken of rather in a mixed strain—good and ill together—while of the merits of Lord Melville there is no doubt in the world, for the noble Lord was a Scotchman, and *always took the plans of Sir John Sinclair into consideration!* A sure sign of strength of mind.

We expected to have found much more interesting matter relating to agriculture and manufactures than we have succeeded in discovering. Some letters of Washington, one of which gives a rapid sketch of the United States, which we might perhaps have quoted, did our limits permit, are by far the most valuable of all—indeed, the glory of America seems to have paid much more attention

THEORY OF LOCOMOTION.

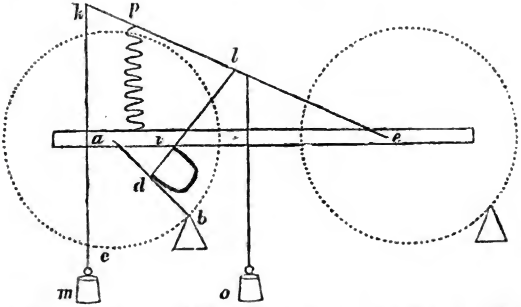
(Concluded from our last.)

Sir,—I resume this subject with a few words in regard to abutments. Saxula does not appear to have acquired very clear ideas respecting the third law of motion. The *existence* of force can hardly be conceived, unless in reference to two or more bodies; any more than we can have any idea of the motion of a body, which should exist alone in universal space. The *action* of force appears to be necessarily reciprocal, or, in other words, action and re-action are equal. Hence, in the case of motion, bodies are abutments or mutual points of re-action for each other; and therefore Archimedes (and Saxula strengthens himself with the celebrated saying of his) did not require a position *out* of the world in order to move it—he in reality did move it when he hurled his missiles on the Roman fleet. In the mutual action of two bodies, no reason can be assigned why the force must of necessity be situated in one of them in particular, and not in the other. Though it is convenient at times to consider the forces of bodies as residing in their common centre of inertia, to which, as a fixed point, their mutual motions may be referred; and though in some cases, as that of a magnet and a piece of iron, it is difficult to say where the force actually exists, yet it is evident, that in respect merely to the mutual action of two bodies, such as comes within the sphere of human means to produce, it is quite indifferent whether the force be placed on this or that; and the same must continue true if one be indefinitely larger than the other. Hence Archimedes demanded an unnecessary condition. A and B are two bodies, which are to be moved relatively to each other. The power, it has been seen, may be placed on either; and whether the force be unmodified, or a lever be introduced, there will be two points of action, which are mutually points also of re-action, and are identical with the points with which the lever is in contact. One of them is also called the fulcrum, which is a term *relative to the lever*, being its centre of motion, and is determined, as we have already seen, by the presence of the power. If it is placed in A, the fulcrum is at *a*, and the abutment or point of re-action is at *b*; whilst the lever is of the first order, and the force and effect of equal intensity. If the power is placed in B, the fulcrum is at *b*, and the abutment is at *a*; whilst the lever is of the second order, and of double efficiency. Now, this is true, whether the bodies be equally moveable, or one of them be immoveable, as it is called; that is, whose motion is not appreciable, for the essential conditions remain unaltered, and the difference is only as to the distance of motion (not its quantity), that one has more than the other from a quiescent point, for which point we may take their common centre of inertia.



The abutments here spoken of, are the points of re-action as between two bodies. The part from which the power acts on the lever may also be termed an abutment. I wonder Saxula did not call to mind the reciprocality of the action of force, and the indifference of this law, to the relative motions and magnitudes of bodies, when he said that there was a struggle for the fulcrumship between the boat and the water. Where did he conceive that he could draw the line where one ended and the other began? From what cause, and at what moment, can he assign an instantaneous change—and if not instantaneous, where, in the progress of it, is the fulcrum? He will probably answer, that the change took place at that moment when the boat was put in motion; then the water *never* was the fulcrum—for it never ceased to move. This criterion, therefore, of the place of the fulcrum, fails for both bodies. The truth is, that with the action of the force there commenced a simultaneous motion in *both* bodies. Whether the boat is aground, or its inertia only is to be overcome, or whether it is being rowed, the action of the force on the water and the boat is reciprocal, the quantity of motion in each is the same, and the only difference is in their comparative velocities—a difference, indeed, which may at first be all but infinite. Some may say, Where, then, is the disadvantage of acting on a moveable abutment, since the quantity of motion produced is in all cases the same? To which it is not digressing from this branch of the subject to reply, in the words of a communication of mine, inserted in the 11th volume of your Magazine, No. 303, relative to the action of the paddle-wheels of steam-boats:—"If your correspondent meant to infer that there is no loss of power when re-action is afforded by a yielding fulcrum,* because action and re-action are equal, he is greatly mistaken. The expression, 'loss of power,' does not refer to an absolute deficiency of effect—for effects are in all cases proportional to their causes—but to a production of other effects than those which are desired." Thus, if the bodies A and B are equal, they will each be moved the same distance from their quiescent point; but if B is indefinitely larger than A, the latter will be moved twice its former distance, which is the particular effect that is wished to be produced; while the momentum is the same, in each body in both cases, the power being the same. The motion of B not being required, is superfluous, and causes a waste of power. From what has been said on this head of inquiry, Saxula will not fail to perceive, without its being more particularly pressed home on his attention, that there *is* a difference between fulcrum and abutment—that while he was talking of one he meant the other—that though we *can* carry our fulcrum with us, we cannot climb to the moon, because our abutment, in a resisting medium would soon fail us—that the place which is wanted *out* of our locomotive-machine, is a point for re-action, and not for a fulcrum—and that when he says, "no progressive motion can be had from an abutment absolutely moveable at the same rate as the power," he means an abutment already *moving* at the same rate and in the same direction as the acting force. If he denies this to be his meaning, then I say the proposition may peradventure be relevant, whenever he can find an abutment which can be moved without affording any resistance; but under the present constituted order of things, it is saying that we cannot produce locomotion by acting against—nothing.

We come now to the diagram that I gave for the purpose of convincing Saxula, that locomotion is possible, though the force should act in a line falling *behind* the obstacle to be surmounted. But Saxula would rather not be convinced *all at once;* he chooses to wait till I have pointed out where the abutment is to be placed, in what line of direction the power is to act, and how the force is to be represented by a weight. I will do all this, though the two former particulars were not omitted before, for a line pointed out the direction of the force, and its terminations were the points of action and of abutment. The abutment here mentioned is not that from which locomotion is obtained, which of course is the ground, but that point in the machine from which the power acts on the lever.



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* I used the term in this place in its more vague signification of an abutment. Though the scope and meaning of a passage determine the sense in which the word is used; yet it would be well if its application were restricted to the lever. Saxula would have profited by it.

The diagram in the preceding page is similar to the one which accompanied my former communication, only I have lengthened out the frame to admit the fore-wheel. The same letters refer to the same points in each. *ab* is a lever (one of the spokes of a wheel), *d* the point of action (representing a crank on the axis of the wheel), *a* the fulcrum (or centre of the wheel), and *b* the point of re-action on the ground. I have now represented the power by a bow-spring, abutting on the frame *ac* at *i*, acting on the lever at *d*, and in a direction differing little from the line *di*. I say again, that if the obstacle *b*, supposing it to be moveable, can be forced to a point perpendicularly under *a*; so also the fulcrum *a*, supposing it to be moveable, can be carried to a point perpendicularly over *b*; and this can be done by "*the same kind of power, acting at the same place, and in the same way.*" Why not? Let Saxula or Hezron show. Here we are at issue, upon a point so palpable and unqualified, so decidedly right or wrong, that there can be no evasion. The onus at present lies with them. But Saxula wishes to see the power represented by a weight. I would first observe, that steam or spring-power, and gravity, being forces of a different kind, must not be treated precisely in the same way in order to produce the same effect. Let *kc* be a lever, and *dl* a rod, and the weight *m* will produce the same locomotive and ascending effect as the spring, though its line of gravitation falls far behind the obstacle to be surmounted. But what will surprise Saxula still more, is, that the weight *o*, though falling on what he considers to be the right side of the obstacle, will not produce ascending locomotion; but, on the contrary, will force the carriage back, supposing it to have already surmounted the obstacle in part. The "*theory*" of this, I leave as a puzzle for Saxula, in return for the puzzle with which he treated your readers. He will probably wish to know, where I consider the abutment to be in regard to the force acting on the point *k*, inasmuch as I have assigned the point *i* for the abutment of the spring. I answer, nowhere in regard to the machine; and here is a great oversight in his theory, for he considers the motive-power of steam to act precisely in the same way as a weight; and imagines that it ought to produce the same effect when suspended from the same acting point, although the former has its point of re-action* (subordinate to the machinery) within the machine itself. That there is a considerable difference, may be seen from this—that if a contracting force, a spiral spring, for instance, be applied to act from the frame *ac* to *p*, or to any other point on the lever, it will produce ascending locomotive effect; though the weight will effect nothing on one point, and on some others will produce even a retrograde motion. That a power without the machine, acting on some part of it, shall produce locomotion, while a power acting on the same point from within shall be ineffectual, is clear enough; but it is not quite so obvious, that a power without the machine shall be inefficient, while a power acting from within on the same point of the same lever, and in the same direction, shall produce progressive motion. The explanation of this I must leave for the present. It is singular, that though Saxula (or, at least, Mr. Clive) admits that the power when carried by the wheel does not act like an external force, yet he illustrates and argues upon a power which is within the machine by the representation of a power out of it. Besides, gravity acts only in one direction, whereas a motive-force within a machine can act in any direction in any plane. I cannot now enter into the question, whether steam-power can be most advantageously employed by acting directly on the machine, or indirectly through the medium of gravitation; that is, by making part of the load the direct acting force. It is a curious subject, and deserving investigation; but let not steam-carriage projectors take up this idea too hastily, and think to foster it as "the germ of a surprising growth" in patent locomotive inventions; for, despite the theory, it may disappoint their expectations.

I must now conclude with a few incidental and unconnected remarks. There is a principle involved in this subject, which probably Saxula has not overlooked, though he has misapplied it, and to which he may allude, when he says, that "the simple theoretical secret is not yet disclosed, either by Mr. Clive, Saxula, or any one else." We shall see. Of his twelve propositions, the fifth is so vague that it can hardly be said to be correct or incorrect. It is true in some cases, and false in others. The eighth is erroneous in regard to the fulcrum; and the ninth is wrong only in his application of it. The rowing of a boat and the propelling of a carriage through the medium of its wheels, are not so different as he imagines. The former moves only in one plane, the latter occasionally in two planes; but the means employed are the same in both motions and in both cases. Having myself constructed two or three locomotive, or rather manumotive-machines, some ten or a dozen years ago, I feel indebted to Saxula for having agitated this question, for my ideas on the subject were getting a little *rusty*. Hezron cites a quotation, but I think he misapprehends the purport of it, to show that the subject in discussion is one of great difficulty. It certainly requires a little consideration, but I am not aware of any peculiar difficulty attending it, except such as may arise from its being an original inquiry—at least, it is such to me—but by a recurrence to first principles, we always obtain a safe guide. The necessity of controverting all the authorities in an important point implicated in this discussion, or rather of correcting their oversight in this particular, certainly imposed the task of a somewhat *circumspect* investigation. I should feel greatly obliged to any of your readers who would inform me where this subject, in the point of view which has been taken of it, has been treated by any writers.

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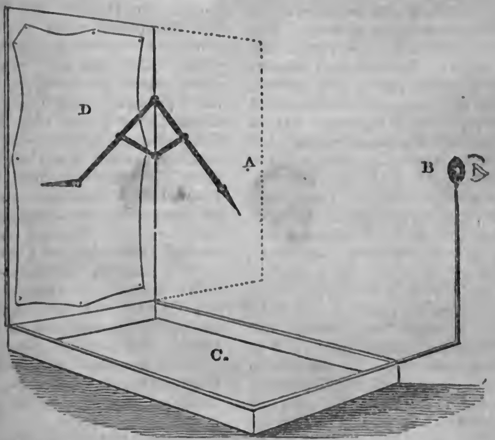
* Not Pat's scheme of action and re-action, when he jumped into the boat with the intention of pulling it along.

Yours, &c. B. C.

PERSPECTIVE PANTAGRAPH.



Sir,—I beg to submit to your numerous readers, through a page of your Magazine, a sketch of a plan for the application of the pantagraph to perspective drawing.

The pantagraph here shown is of the common form—I have seen one whose sides form a square, which, perhaps, would answer this purpose better, as it would be much firmer. Instead of a tracer at the right-hand extremity A, there is a small hole, ⅛th of an inch wide, to be used as a sight, and the bar is continued an inch or two, for the purpose of a handle. At the other extremity is a pencil or tracer. Great accuracy is necessary in its construction, and delicacy of movement is indispensable.

C represents a box to contain the instrument and other requisites, the lid of which, when in use, is made to stand perpendicularly by proper stays, &c., and, as it is used as the drawing board, its dimensions may be proportioned to the range of the instrument, which is fixed in the middle of its right-hand side.

B is a sight; which, when attached to the front of the box, ought to stand exactly opposite to the centre of the "transparent plane" shown by the dotted lines.

When the box is fixed, and the "point of sight" B, is properly adjusted, it is evident that if the outlines of an object, as seen by the eye at B, through *both* sight holes, be traced by the extremity A, similar but inverted lines will be made by the pencil upon the paper, tacked on the upright board D.

Trusting that in the hands of some of your readers it may prove useful,

I remain, yours, &c.

J. EYRE.

Derby, March 25. 1831.

MR. BERNHARD'S NEW METHOD OF RAISING FLUIDS.

Sir,—I have been favoured by a friend with the perusal of an official report of an experiment made at Munich, on the 25th of September last, before a number of the most eminent men of science of that capital, for the purpose of determining the merits of a new method of raising fluids, discovered by Mr. Anton Bernhard; and as the results are at once curious and instructive, perhaps a brief summary of them may not be unacceptable to the readers of the Mechanics' Magazine.

Mr. Bernhard, as you are probably aware, (Mr. B. having some time since taken out a patent in England for his apparatus) claims to have found out a mode by which fluids may be made to ascend bodily to any height desired; which mode may be described in general terms as consisting, first, in taking off the pressure of the atmosphere from the top of the fluid by means of an air-pump or other exhausting-apparatus; and, secondly, in applying heat to the bottom of the column so relieved from all superior pressure. Mr. B. affirms, that the only practical limitation to the height to which he can thus raise fluids, is the degree of perfection to which the vacuum can be carried.

The fluid experimented with at Munich was quicksilver. A tall vertical tube was filled with it to the height of 3 feet 3 inches. After about half an hour's pumping, the vacuo-meter stood at 25 inches, and the heat being simultaneously applied to the bottom of the column of quicksilver, it began to flow out, with great velocity and in one unbroken stream, at a cock about 6 feet above the first level of the fluid. Before this cock could be shut, there ran out from it, in less than 15 minutes, 40lbs. of the quicksilver, although the bore of the aperture was scarcely one line in diameter. The aperture was then stopped, and shortly afterwards the quicksilver rose to another cock, about 13 feet 9 inches above the first level of the fluid, on opening which the quicksilver again issued forth, but in a much thinner and slower stream than before. This second cock being also closed, the quicksilver finally gained a total height of 14 feet 4 inches, which, considering the comparative gravity of the fluids, may be considered equivalent to 200 feet in water! From that height the fluid descended through a series of cooling or refrigerating tubes to a reservoir in connection with the hot-ascending tube—performing thus a complete circuit of revolution in the course of the experiments.

Presuming that this is a faithful account of what was witnessed on this occasion, I may be allowed to express my surprise, that a discovery of such obvious practical importance should not have hitherto attracted more attention from the scientific world. Trusting that the insertion of this notice of it in your extensively-circulated Journal, may help to rescue it from the neglect which it appears to me to have most unjustly experienced.

I remain, Sir, yours, &c.

H. F.

London, March 10, 1831.

[Mr. Bernhard's plan underwent a

good deal of discussion here, about a twelvemonth ago, in two contemporary journals, and we must confess we thought with those, who then pronounced it to be exceedingly visionary. He has since (or some friend for him) re-published the whole discussion in a separate pamphlet, in which complaint is made that he had not fair play on the occasion—that the opposition he experienced was "hard-hearted and cruel"—that no opportunity was allowed him of "making experiments on a sufficient scale," &c. &c. We shall give no opinion as to the justness of these complaints; but as Mr. B. and his friends insist so strongly for a re-consideration of his case by the British public, we shall feel well pleased, if the report which we now publish of his recent experiments at Munich, should be the means of obtaining for him all the satisfaction he desires in this respect. For the guidance of those who may take the trouble of investigating the matter, we subjoin a short abstract of Mr. Bernhard's own accounts of his invention.

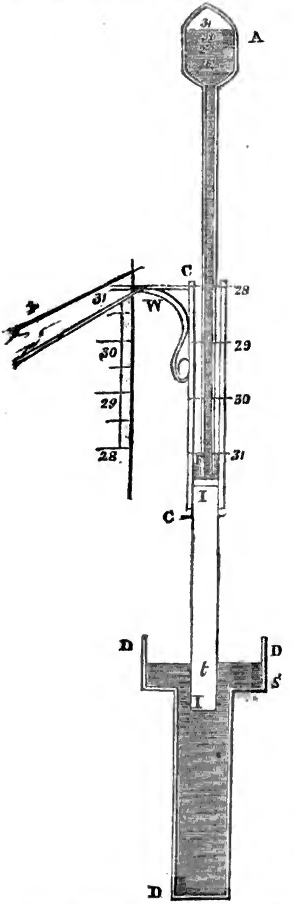
The invention is described in Mr. B.'s specification as consisting of a new method of raising fluids "by means of an apparatus acting on the combined principles of exhaustion, atmospheric pressure, heat and condensation, or refrigeration; which principles are simultaneously brought into action by a new combination of the air-pump condenser, or refrigerator, and Torricelian column." The *modus operandi* is as follows:—The apparatus, which is ordered to be perfectly air-tight, is to be first exhausted of as much of the included air as will cause the water in two vertical pipes, A and B, each connected with a separate reservoir, to rise to a considerable height, say 30 feet; heat is then to be applied to the bottom of the column of water A, till it ascends some 30 or 40 feet higher (Mr. B. says it may be made to rise not only 50 or 100 feet, but, if necessary, 500, 1000, or 5000 feet!) after which it is made to pass through a series of refrigerating (condensing?) pipes, which terminate in the upper extremity of the pipe B. The water of A being thus transferred over into B, "increases the column of water in that pipe (B) to a height greater than the atmospheric pressure below will sustain; "*and thus*," says Mr. Bernhard, "a portion of water equal to that which flows into the pipe (B) at its upper end, will constantly flow out of it at its lower end," into the reservoir from which B was first filled. "It is, therefore, evident," continues the Patentee, "that a constant fall of water, 50 feet in height from the waste pipe, may be obtained for any purpose required." As this might not seem *so* evident to others, as to the patentee himself, he adds this qualifying remark, "It may be as well to observe, that the height of the said fall of water will always be determined, in an apparatus of this kind, by the distance between the surface of the water in the reservoir, Y, and that in the cistern, S," (that is the respective reservoirs of A and B.)

Mr. Bernhard, after taking out his patent, made an actual trial of his plan in a tower about 70 feet high, contiguous to the Surrey Canal Bridge, Kent-road; and persons of credit have certified that they there saw water raised by it to a height of nearly 70 feet—(vide London Journal, for July, 1829.)

A suggestion having been thrown out, that it must have been the water converted into steam, and not the water itself, that was raised that height, Mr. B. met it with the following positive contradiction:—"In my special application of my apparatus, it is clear that I have raised water and not, as supposed, steam, 40 feet above the Torricelian result."

When asked on what principle so paradoxical a result could be accounted for, Mr. Bernhard attributed it all to the expansibility of the water, when subjected to the action of the heat. "I am convinced (said he) that those practical engineers, who have written, declared and maintained, that water, or other fluids, governed by the same natural laws, cannot expand, separate its particles, or diminish its specific gravity, under any circumstances, by heat, to a greater extent, than perhaps 5 per cent. of its volume, are all in error. I have, by continued study, through a great number of years, convinced myself by calculations, that water, under such circumstances as I have shown in the description of my apparatus, will become expanded or diminished in its specific gravity *to every useful extent*, and can consequently be raised by that apparatus to *every useful height* and in *every desired quantity!*"—Ed. M. M.]

SELF-REGISTERING BAROMETER.



Sir,—The above figure represents the essential parts of a Self-registering barometer, which I have recently contrived; these are the barometer tube AF, and two cisterns CC and DD, one of which (CC) floats in the other. The upper end of the tube for five or six inches, at A, is enlarged, as shown in the figure; the remainder is of the size of a small common barometer tube. This tube is fastened firmly on a board, after the manner of the tube in a common barometer, only leaving enough of the lower part exposed to permit the cistern CC to travel up and down.

The scale at A is three inches long, marked off and numbered from 28 to 31. At 28 inches distance from the lowest number, is the mark F, made on the lower end of the tube; at this mark the *surface* of the mercury in CC must constantly stand, when the barometer is in use. An *inch and a half* below the mark F, the tube is to terminate. When the barometer is used, the height of the column of quicksilver is seen by the scale at A, as in a common barometer.

The floating cistern CC, is a cylindrical glass vessel, having the float II cemented into the lower end; the top of the float being in fact the bottom of the cistern; on the top of the float, before it is cemented in, is to be glued a piece of fine cork. The float is cylindrical, of the same diameter as the inside of the cistern CC, and may be made of wood, ivory, or glass. When the parts of the instrument are put together, the floating cistern plays between two side pieces or guides, fixed on the same board with AF, in such a manner that CC may move up and down quite loosely, at the same time that it is prevented from falling against the tube AF.

In order to obtain the lower scales, having filled the tube AF, and put the cistern CC in its place, allow the mercury to run out of the tube until it comes down to 31, when it is to be stopped and CC emptied; the mercury is then to be allowed to run out of the tube again, until it has fallen in A to 28; by this means, the portion of mercury which had been contained in A, between 31 and 28, is transferred into CC, from which it is to be emptied into a vessel by itself, and carefully set by. The flowing of the mercury can at any time be easily stopped by pressing the bottom of CC, which is composed of cork, up against the end of the tube. First, having emptied AF, replace CC, and raise it until the cork in the bottom comes almost in contact with the lower end of the tube, in which position it is to be held while quicksilver is poured in till the surface just reaches the mark F on the tube. The place to which the surface rises in CC also, is to be scratched with a file, and marked 31. Now, let the portion of mercury which had been set by, be poured into CC, lowering it at the same time until the surface stand at F about the tube, when its place in CC is to be scratched with a file, and marked 28. The distance between these scratches, 31 and 28, on CC, is the length of the scale answering to that on A; that is, it is the distance through which CC will move, whilst the mercury is rising or falling in A between 28 and 31. Lay off the distance thus found (first adding so much to it as the surface in DD is likely to rise when the float sinks to C) from C downwards to *t*. The remaining part, *t* I, of the float, is to be of sufficient length to support the floating cistern, containing mercury to the depth of an inch and a half, when held perpendicularly in a vessel of that metal; but should *t* I be a little longer, it would not signify. Now, let mercury be poured into DD, till the wide part at S be just covered; and, having put CC in its place, the end of the tube nearly touching the cork at the bottom, and the quantity of mercury in it just sufficient to rise to F, slide up the cistern DD, until the float of CC is sufficiently immersed to sustain the latter in the position just described, and there the fastenings of DD should be fixed. Pour a little more mercury into CC, and if the surface stand above F on the tube, a little is to be pared or filed from that part of the float immediately *under and over* the surface of the mercury, in which it is immersed, which, of course, will have the effect of making it sink deeper; and, by repeating the operation, the surface in CC will be brought to the desired level at F; then pour in a little more, and, if necessary, repeat the cutting or filing, so proceeding until the surface of the quicksilver, the scratch on CC marked 28, and the mark F on the tube be all on a level.

The cistern DD being taken away, the tube AF is to be once more filled, and CC being in its place, the quicksilver is to be drawn out of A until it stand at 31; CC is then to be emptied excepting so much as will rise about the tube to F, then replacing and fastening DD, the pressure of the atmosphere will adjust the height of the column above F, and the weight of the mercury in CC will sink it and the float together to a proportionate depth; the surface about the tube always standing at F.

The scale, which is inverted on CC, is to be transferred to the side-piece, as shown in the figure, and subdivided. A wire *w*, fastened to CC, is to pass over this scale, the end of which being turned up, catches the ends of two thin slips of wood, *rr*, (only partly exhibited in the engraving) which are poised on fine axles; one of these is placed above, the other below the index wire, which, as it moves, will push one forward, whilst it leaves the other behind: thus marking the greatest height and depression within any observed time.

As the vessels A and CC may not be truly cylindrical, the best way to find the scale on CC, is to go through the same process for each inch or half inch of the scale at A, as is here described for the whole scale; where all things are prepared, this would be done in less time than a description of the operations could be read.

It is obvious that the length of the lower scales will depend on the diameter of CC, as compared with that of A; if CC be one half of the width of A, then the scale on the former will be 12 inches long, or four times that on A; if CC be one third the width of A, the scale on the former would be 27 inches, beyond which it cannot be extended, as the mouth of CC could not pass A.

Four or five bits of wire should be stuck round the foot of the float, so as to stand an eighth or tenth of an inch from the surface, in order to prevent the mercury from forcing it against the side of DD, and a piece should be put through it close by C, the ends standing out about as far, which are to be caught hold of for the purpose of forcing the cork against the end of the tube, when it is desired to stop the running of the mercury.

Constructed in this manner, with a little care, the cistern CC suffers scarcely any obstruction in its motion, beyond that which is offered by the fluid which it contains, and that in which its float is immersed; for, the touching surfaces and directions of the motion are all perpendicular to the horizon. The registering slips being poised on fine axles, give no perceptible resistance. But even what little they offer might be got rid of, thus:—Suppose CC were fitted to carry a prepared card, and a reservoir about the size of a nut were furnished with a very fine hair-pencil, and filled with tinted alcohol, or alcohol mixed with a little acid, and moved by common clock-work in such a manner, that it should come in contact with the card at certain intervals of time, the pencil each time leaving a mark behind; by this means the card would become a register of the height of the column, at the times when it was marked by the pencil. Perhaps, a fine black-lead pencil, carefully filed to a point, might be substituted for the hair-pencil and fluid.

In addition, it may be observed, that with the exception of this last-mentioned apparatus of the pencil and card, the barometer as here described, has been constructed, and proved to be at least as delicate in its indications as any of those of the common constructions with which it was compared. The height of the column is pointed out at the same time on the three scales, on that at A as in the common barometer, on the inverted scale on CC by the surface of the mercury in it, and on the side scale by the index wire W.

In the accompanying engraving, the dimensions are taken wide, that the parts of the instrument might be better represented. Were a barometer constructed of the dimensions here represented (A being = 3½ inches in diameter) the mercury, which would descend from A into the floating cistern, when the column stood at 28, would weigh more than 14 pounds.—Yours, &c.

W. M. G.

March, 1831.

DESCRIPTIVE ACCOUNT OF THE PRINCIPAL BRIDGES ERECTED OVER THE RIVER THAMES, BY MR. C. DAVY, ARCHITECT.

No. XX.

MR. ALLEN'S CLAIMS.

Upon the supposition that the "Description of the Bridges over the Thames" may interest many of your readers, and from a knowledge that it does concern those for whom these communications were intended, I hesitate not to extend my remarks on the various plans for the approaches. The necessity of this step will be instantly seen, when your readers are informed that all the concomitant expenses have been incurred from a neglect in observing the localities of the site. To give even a digest of the several plans that have been proposed in the voluminous reports and memorials of those immediately concerned would far exceed the limits of the largest periodical —and if in this I may appear to fall short, it is for want of space rather than matter. I therefore proceed with as much regard to brevity, as the importance of the matter warrants.

In addition to the claims already put forth by Mr. Allen, a fourth memorial further informs us, that his suggestion for opening a new lateral street leading from the foot of Martin's Lane, in a line towards the Monument, has been adopted; and that the labour he underwent, "in collecting and producing evidence in favour of a dry arch over Thames-street," he conceives, influenced in some degree the New Bridge Committee in arriving at their eventual determination on the subject.

Mr. Allen next opposed the ascending planes, together with Mr. Jeffrey's frightful acclivity, with such force of argument and demonstration, that Mr. Alderman Wood, the chairman of the committee, publicly stated, "That the New Bridge Committee had had laid before them such strong evidence against the lateral ascending planes in Thames-street, that they had come to a determination to abandon them.

Mr. Allen next proposed a plan for the formation of a "new street, extending from the back of the Monument, and by St. Dunstan's in the East, into Tower-street and Lower Thames-street." This idea was thrown out on the 8th of December, 1828; a memorial in its favour was afterwards sent in by the Honourable the Commissioners of Customs; and, since that time it has been partly adopted.

It was also proposed, as a part of the same plan, that the space on the bank of the River Thames at the foot of Fish-street Hill, should be converted into a wharf or quay for the reception of steam packets. This is also to be adopted.

Lastly, Mr. Allen claims to be the first and only party who designed a plan for the formation of a new approach from Tooley-street, passing in a directly straight line for the watch-house, towards St. Saviour's Church: "He has exerted every means in his power to exhibit to your Honourable Court and the New Bridge Committee, the great advantages which would accrue from the formation of such a new line, and leaving the old street upon the same level as at present, to pass under a dry arch, and so to form a more direct communication than has hitherto existed along the southern banks of the Thames, with the western portion of the metropolis." The plan thus suggested was adopted, line for line, by the engineer of the new bridge.

Having thus, in a condensed form, given an account of the services Mr. Allen has rendered in this great work, I shall, in order to show the extent of traffic over the principal bridges, subjoin a table of the average number of passengers and vehicles that daily pass by these means of communication.

	Blackfriars.	Old London.
Foot passengers	61,069	89,640
Waggons	533	769
Carts and drays	1,502	2,924
Coaches	900	1,240
Gigs and taxed carts	500	485
Horses	822	764*

Mr. Britton observes, that the calculation was made on both bridges on the same day, in July 1811; and further, "On the average of six weeks' daily counting, in the summer and winter of 1808, there passed over Westminster Bridge 32,000, and over Blackfriar's Bridge 48,000 persons, every twenty-four hours; but, on a fine Sunday in August, upwards of 70,000 persons walked over the latter bridge." A later account as to Thames-street and London Bridge, will be given in a future communication.

(To be continued.)

PLOUGH OF THE HOLY LAND.

In the Travels, (3d edit.) just published, of Mr. Rae Wilson, through Judea, Galilee, and Samaria, we have the following description of the plough used in these interesting countries.

"The ground here, as in Britain, is broken by the plough, which, being drawn by oxen, reminds us of many passages of Scripture, where those are mentioned (1); and, from the number employed, an idea is formed of the wealth of their owners. (2) This machine is altogether differently constructed from that used by British husbandmen; but although rude in its formation, it is extremely simple, and serves all the purposes required. I obtained a model of one at Nazareth (3), and an accurate representation is given of it in the sketch I have introduced of the village. This plough is not moved upon wheels; the share, which is small, scarcely grazes the earth; and it has only one handle or shaft, with a small piece of wood across the top for the husbandman to guide it, resembling the head of a staff or the handle of a spade. The man holds this in his right hand, and carries a long stick in his left, with which he goads the oxen. The whole machine is made so extremely light, that a person might with facility carry it in his arms. The share is covered with a piece of broad iron, pointed at the end, so as it might be converted into a weapon of warfare. In all probability, it is to this peculiarlity that one of the prophets refers, where he calls on the nations to relinquish rural occupations, and convert their ploughs into instruments of battle. (4) Another of the sacred writers has reversed this recommendation, and applied it to that tranquillity with which it is prophesied the church shall be ultimately blessed in the latter days. (5) In viewing the operations of the oriental plough from a short distance, you might suppose that the person who conducted it was merely amusing himself; there appeared in him such a careless indifference, arising most likely from the soil being light, and it not being necessary to make the furrows deep. At other times, however, he may be seen to lean over the top of the shaft, so as to press it with his weight, to prevent the plough from skimming along the surface. To this watchful and steady care I conceive our great Teacher has introduced an allusion in a remarkable declaration of the sacred record; and I cannot mention this instrument without remembering the words of an apostle. (1)

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* See Hughson's London, and Britton's Public Buildings, p. 326.

(1) Luke ix. 62. Jer. xxvi. 18. Hos. x. 12, 13. Job. iv. 8. 2. 2 Cor. ix. 10.

(2) 1 Kings, xix. 19. Job. i. 3.

(3) Models of this plough may be seen in the Museums of the Universities of Edinburgh and Glasgow, and the Highland Society of Scotland.

(4) Joel, iii. 10.

(5) Isaiah, ii. 4. Psalm xlvi. 9. lxxvi. 3.

(1) 1 Cor. ix. 10, 11.

"I again observed, as I had before done when travelling from Ramah to Jerusalem, that the seed is scattered upon, and afterwards ploughed into, the ground; although, in many parts of this country, the land is so covered and choked up with stones, as to excite the utmost surprise how a plough can possibly turn up the soil at all, and any thing be produced by it. Notwithstanding these apparent obstructions, however, the most bountiful crops are raised in such "stony ground," (2) which is also evidently referred to in the parable respecting the sower. (3) In the hill country, terraces are formed to keep up the soil, which are occasionally washed by violent rains that would prove a serious damage both to the crops and houses of the inhabitants; and it is to an event of this kind that our Lord refers. (4)

It must be kept in view, that the barren appearance of the Holy Land in general is not to be attributed to a defect either of the soil or climate, but arises from the scantiness of its inhabitants, and the oppression exercised by rulers, which places an embargo on the operations of the husbandman, or tends to discourage him from using his activity. If these obstacles were removed, the country would still correspond with the description of it which has been given in the book of truth, and be, as of old, "a land flowing with milk and honey." A stronger proof of its fertility cannot be adduced than the fact that the country of Judea alone, at one period, brought into the field more than three hundred thousand, and at another two hundred four-score thousand (5) "mighty men of valour," in order to oppose an army of one thousand thousand.

"The mode of collecting the harvest is, to lay the sheaves on camels, which being afterwards put up in heaps are trodden or threshed out, as of old, by oxen walking in a circle over them. (6) Another practice is that of placing the grain between two round stones, the upper balanced on a wooden peg on the lower, and turned round; an operation performed by two women, sitting, one feeding and the other turning—thus affording a strong commentary on the words of our Lord. (7)

Scientific Congress.—Sir, The following notice appears in the *Literary Gazette* of Saturday last:—

"*Great Scientific Meeting to be held at York.*—Arrangements are now making to hold at York, in July or August next, a Meeting of the Cultivators of Science from all parts of the British Islands. The object of the Association is similar to that of the German Society of Naturalists and Philosophers. The sittings will continue for a week. The Lord Mayor and other authorities at York have, as might be expected, entered heartily into this plan, and the Philosophical Society of that city have kindly offered to charge themselves with any preliminary arrangements which may be necessary. Scientific individuals who propose to attend, or to become Members of the Association, are requested to communicate their intention to John Robison, Esq. Secretary to the Royal Society of Edinburgh."

As the deliberations of such a body cannot fail to be interesting to the world at large, perhaps some of your York correspondents will indulge the readers of the Mechanics' Magazine, by communicating all that may come to their knowledge of its various proceedings.—Yours, &c. T. M. B. *April* 25, 1831.

Brasiers.—Sir, The Old Tinker, who, in your last Number, rather superciliously requests that the Son of Vulcan will when he next writes, "send *something more to the purpose*"—before he called the "heavenly farrier's" progeny *to order*, should have looked into his Dictionary. He will find in Johnson two meanings given to *Brasier*, *or Brazier*—the first, one that manufactures in brass; the second, *a pan to hold coals* [probably from *embraser*, Fr.] This is evidently the *Brasier* alluded to by your first correspondent.—Yours, &c. T. M. B.

National Benefactors.—The names of those who have enriched our gardens with useful and valuable plants are deserving of record and remembrance. Sir W. Raleigh introduced the potato. Sir Anthony Ashley first planted cabbages in this country; a cabbage appears at his feet on his monument. Sir Richard Weston brought over clover-grass from Flanders in 1645. Figs were planted in Henry VIII.'s reign at Lambeth by Cardinal Pole; it is said that the identical trees are still remaining. Spilman, who erected the first paper-mill at Dartford, in 1590, brought over the first two lime-trees, which he planted, and they are still growing. Thomas, Lord Cromwell, enriched the gardens of England with three different kinds of plums. It was Evelyn, whose patriotism was not exceeded by his learning, who largely propagated the noble oak in this country; so much so, that the trees he planted have supplied the present navy of Great Britain with its chief proportion of that timber.—T. M. B.

INTERIM NOTICES.

Mr. Gray's letter in our next.

W. W. wishes to know the address of Mr. Twiss, jun. (Vol. XIV. p. 415.)

The solutions of W. W. F. have unfortunately come too late to hand; but they evince a degree of talent which makes us desirous of hearing from him again.

Communications received from Σ—G. S. No. 90—Sir George Cayley—A Lover of Aquatics—A Vulgar Fraction—Hezron—A. C. T.—A Humble Enquirer after Practical Knowledge—Mr. Bakewell—Saxula—Ginjal.

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(2) Deut. viii. 9. 2 Kings, iii. 19. Isaiah, v. 2. lxii. 10. Mat. iv. 3.

(3) Mat. xiii. 8.

(4) Luke vi. 49.

(5) 2 Chron. xiv. 8.

(6) Prov. xiv. 4. Dieut. xxv. 4. 1 Cor. ix. 9.

(7) Exod. xi. 5. Isaiah, xlvii. 2. Matt. xxiv. 41. Luke, xvii. 35.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

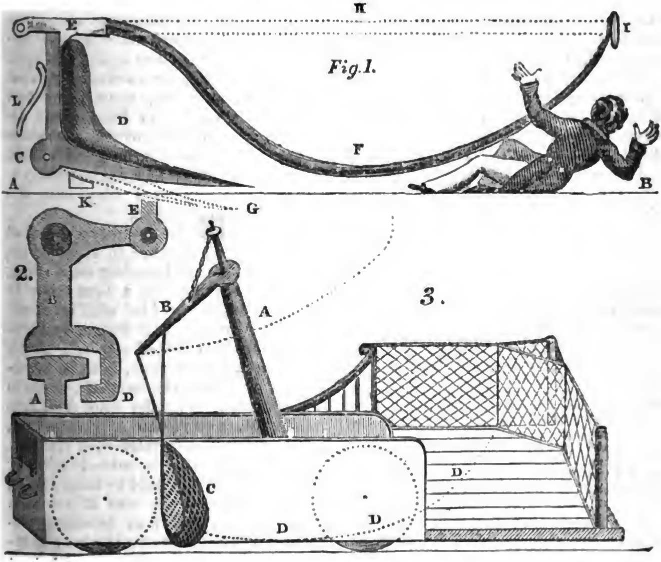
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 404.] SATURDAY, MAY 7, 1831. [Price 3*d*.

> "We are a little kingdom; but the man
> That chains his rebel will to reason's throne,
> Forms it a large one, whilst his royal mind
> Makes heaven its council; from the rolls above
> Draws its own statutes, and with joy obeys."—WATTS.

SIR GEORGE CAYLEY'S IMPROVEMENTS IN RAILWAY-CARRIAGES.



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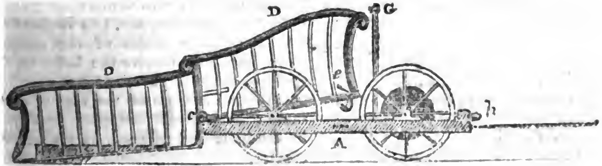

PRACTICAL HINTS ON RAILWAY TRAVELLING. BY SIR GEORGE CAYLEY, BART. PRESIDENT OF THE YORK MECHANICS' INSTITUTION.

Sir,—Several plans have been floating in my mind ever since I witnessed the fatal opening of the Manchester and Liverpool Railway, which I now send to your widely-circulated Magazine, where they will meet the eye of the practical mechanics, and suggest improvements, till they may, perhaps, effect the purpose intended. There can be no doubt that railway conveyance must and will prevail to a great extent, both here and on the Continent; but at first there will occur, as lamentable experience has but too plainly shown, most serious accidents. The more, however, these can be traced to their causes, and, as it were, anticipated and provided against, the fewer will occur, and the sooner all prejudices will be removed that may impede the progress of this most desirable and advantageous mode of conveying both persons and moveable property.

In the first place, it occurred to me, and I believe to many others, at the time the accident happened to Mr. Huskisson, that had some species of guard preceded the wheels, that appalling event might have been avoided;* but although the primary conception of some sort of guard is very obvious, it is by no means so easy a matter to prescribe what in practice will prove a good and sufficient one; and even the best will have its attendant evils. It appears to me that there are two points especially to be attended to; first, that the lower portion of the guard must be so near the road on which the rail rests, and also to the top of the rail itself, that there may not be space left in which a limb can be mutilated; secondly, that it shall not strike so forcibly, when moving with the extreme velocity of these carriages, as to endanger life or the fracture of any limb. The road is necessarily so uneven in various places as to render it impossible for any fixed edge to be so adjusted as to answer the first of these points; hence the necessity of some new adjustment of the apparatus at the moment of accident, either to depend upon the person guiding the carriage, or, what will be much better, upon the actual presence of an object in front of the advancing engine, when within the sphere of danger; this may be effected various ways; I shall suggest only one, merely to convey the idea; for I only offer this paper as a series of hints.

Let AB, fig. 1, be the railway, and at any convenient distance in front of the leading steam-tug, hingeing on a strong gudgeon or axis C, let a firm frame D be bolted on, well padded with an elastic cushion in front. This frame, intended to receive the body of any one on the road incapable of escape, is to be so suspended by a moveable catch E, as not to touch or plough up the road, and thus impede the free motion of the carriage, till the catch E, connected with the trunk or stem of several light-curved feelers or antennæ FF, be liberated by these gliding over any object of the size of a human limb or body, and thus becoming elevated. When the frame is down, as represented by the dotted lines G, its front edge, receiving the rails by a groove made for this purpose, will commence ploughing up the road for, say, two inches deep over the whole width of the carriage path, and thus receive the body on the cushion, without permitting any part to get under the edge of the frame, at the same time gradually stopping the vehicle by the increased friction and resistance it creates.

As small jolts might disengage the catch when not intended or required, it

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* Immediately after this occurrence (25th of September, 1830) a plan of a guard for this purpose was communicated to us by our esteemed correspondent, Mr. Saddington, which, as it bears some resemblance to the one here proposed by Sir G. Cayley, we think it but an act of justice to him to subjoin.—Ed. M. M.

"The plan which I now submit consists of a piece of wood of a moderate thickness, or of iron, attached to the lower part of the frame or bed of the engine, to reach down to within about half an inch of the surface of the rail on the road, having a tongue or point reaching about one inch into the groove on the side of the rail, and placed directly before the wheels. The safeguard should be five or six inches wide, to extend the whole width over the rail and groove, and curve a little forwards towards the bottom, the more effectually to remove any obstacle out of the way of the wheel, which will afford complete protection from any accident of being crushed or run over, as every obstacle would be swept off the rail and groove before the wheel could come in contact with it; and it would be almost impossible for the foot of a person standing on the rail, or a walking-stick placed across it, to receive any injury from the wheels, as the safeguard would remove it off before the wheel could reach it. I shall leave it for the consideration of the Directors, or those more immediately connected with the machinery, to determine whether the fore-wheels only, or all the wheels of the engine and carriages, should have the safeguard placed before them; or whether a rail should be fixed from axle-tree to axle-tree, to prevent any person falling between the wheels; or whether the hind-wheels should have any safeguard behind them, to prevent any accident when the engine is proceeding with a retrograde motion. A machine thus guarded might be driven through a flock of sheep with comparative safety."

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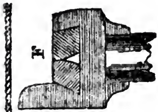

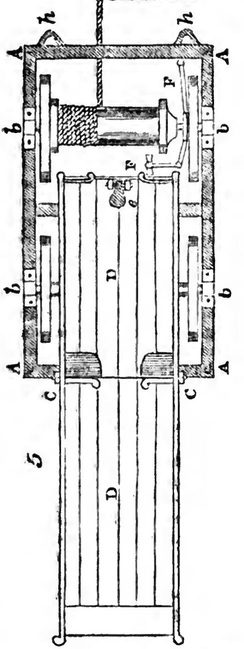

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may be necessary to keep it in its place by such a spring as would readily be overcome by the leverage of the feelers, when any object lifted them sufficiently.

It may also be necessary to support the ends of the feelers with a thong to a ring at some convenient height on the chimney, or other elevated point on the front of the steam-tug, to prevent them from playing too much.

It may also prove advisable to make the car oblique both ways from the centre, so as to meet the body, when not central obliquely, and thus cast it out of the path of the carriage, without so great a shock as the direct impulse must give it, however well stuffed the cushion may be; this stuffing should form an inclined curve, tending to roll the body upwards till its gravity stops it. There must be a couple of flat, light, elastic pieces, attached horizontally from the united ends of the feelers to the stem or sockets that carry them, so as to form, as it were, the gunwale of a boat (see the dotted line H). These will serve to shove off any person standing or moving erect in the path of the carriage, if not exactly central; and this latter case must be provided against by placing a well-stuffed cushion at the ends of the united feelers, the blow from which, it is hoped, from the elasticity of the whole structure, would not be sufficient to create serious injury, but might throw the person down, when, if in the path of the carriage, the plough-car would receive him (see I.)

The car should be furnished with some check to prevent its entering too deep into the roadway, if in any accident the carriage be thrown off the rails, which ordinarily furnish the best check at the grooves they enter. A single block of sufficient strength at K would furnish such a check.

If it be found that the car does not fall with rapidity enough after the catch is liberated, this can be effected by a strong spring, as at L.

Several accidents have occurred owing to the failure of the wheels; this, together with the breaking of their axle-trees, must on the present construction remain a source of serious evils; though these may in great part be obviated, even on the railways now in use, and may be totally done away in those that have yet to be constructed. For this purpose the rails will require to be a little more elevated from their supporting points than at present, as at A, fig. 2. Let four strong iron feet, BB, be hinged upon strong gudgeons CC, at some convenient distance above the rail, each foot being placed as near as possible to one of the wheels in such a manner, that if the wheel gave way, the foot would, by sinking an inch, sustain the carriage on the rail, and act *pro tempore* as a sledge. At present, if any obstacle be accidentally in front of a railway-carriage, it generally throws it off the rail, and then some serious evil results; but if these feet or sledges be made to underhang at some convenient distance, the inner flange of the rail (which in new constructions should be made expressly to suit this purpose) as at D, then small matters could not produce this result, especially if the feet were in front of the wheels; and larger ones would be provided against by the plough and guard before proposed. As in turning into a branch-railway these sledge-feet would be in the way, they must all be made capable of being moved instantly in and out of gear, at the will of the guide, by being connected with some convenient lever common to each, through means of a shank, as at E.

There is another case respecting railway carriages of very considerable importance, that has not hitherto been considered or provided for. The expense of railways must ever cause them to be few in number, and confine them to being the great arteries of communication through various parts of the kingdom; hence, as their power respecting the conveyance of passengers is almost unlimited, it will necessarily become the habit of persons wishing to travel, to go directly to the nearest point of the railway in their vicinity, and there to be taken up by the rail-carriages; this will eventually imply such a multitude of stoppages as will materially inconvenience the progress. The problem must, therefore, sooner or later arise, of furnishing some means of getting passengers on board without materially altering the velocity of the train of carriages, otherwise this can only be effected at certain convenient intervals, say of five miles each, where the train must halt; and perhaps for females and aged persons, and where luggage is also to be taken up, that will ever remain the best plan; but for men of activity, such as pedestrians usually are, and whose convenience may commonly be comprised in short lifts from place to place along the line of railway, I conceive some plan may be hit upon to take them up wherever they are found without stopping the train. I will state two means that occur to me as the most likely to become practicable when improved upon by experience. Let an inclined mast stand on the platform of the hindermost rail-carriage A, fig. 3, on the top of which is a gudgeon or spike, on which turns an arm or boom B, supported by a chain-stay from the top of the spike. From the further end of this boom let any convenient form of rope or net-work hang down within a few inches of the ground, as at C. I conceive, that any active person, by standing in the path of this net or rope, may stay its advance for an instant till secure of his hold, when without further effort he will, by his own *vis inertia*, and the progress of the car, be lifted in a curve DDD on to a rising platform behind the car, guarded by strong netting, and well padded uprights, so as to prevent injury. The momentum of the person would be gradually lost by the hoisting, and by any required degree of friction made by a gripe where the boom or arm turns on the spike. This arm must be prevented from swinging back by a catch and rotchet, till liberated for use. The wheels of this car should be boxed in, so as not to endanger any one who may happen to fail in the attempt. As no velocity would be communicated to the person unless he got fair hold, failures would not be productive of serious accident; and if he lost his hold when within the car, the nets would receive him with little danger of injury. I have adopted the net-bag, because I think a man might place his bundle and his foot in it at the same moment.

Another mode of taking up passengers, which possesses the not less important advantage of setting them down also, may possibly be constructed upon some modification of the following plan:—Let a strong frame (see AAA, fig. 5) receive the four railway wheels, so that they turn on gudgeons inserted into sockets *bb* on the frame, the wheels being firmly fixed to these axles. On the hinder piece of this frame, attached by the hinges CC, is the long but light body of a carriage DD, figs. 4 and 5. This body rather preponderates in its balance backwards, so that the hinder portion, which carries a sort of sledge under it, will rest upon the earth; but if any one be in the front portion, the sledge quits the earth, and the platform of the body becomes horizontal, and will be retained so by a catch at *e*, passing to the under frame-work until again liberated, at the will of the person conducting this department of the train, by pressing his foot upon the leverage of the catch. The axle-tree of the front-wheels must be uniformly cylindrical, and upon it is placed a concentric drum, flanged at each end for the purpose of coiling a rope, and which turns freely on the axletree, unless when pressed forcibly to one side by a pierced gripe FF, moved by the leverage of a handle, when the friction between the end of the drum and the wheel (a proper surface being made on each for the purpose) will gradually bring them into a similar rotation. The uncoiling process being first stopped, and then the tension of the rope being exerted, the wheels commence rotation on the rail, and at the same moment, though an apparent paradox, the rope commences to recoil on the drum, and the carriage to regain its loss of distance behind the train. Suppose the catch *e* fast, and the carriage moving the last in the train, to be attached to the one immediately in advance of it by the usual loops *hh*, or any other contrivance (the carriage in advance being furnished with a small passage-gallery behind it, so as to enable persons to walk from it into this one, through the front opening near the foot-catch *e*, fig. 5); then let the conductor, having placed himself in the front part of the carriage, first liberate the foot-catch *e*, and next disengage the carriage, and immediately place his weight over the sledge at the hinder end of the car, which will soon stop it. He will then hand the person intending to enter and his package into the front division of the car, when the catch *e* will take hold, the sledge being lifted off the ground. He must then apply the gripe F to the drum, when the coil of the rope being led from the *under* side, will, by receiving its motion from the revolution of the wheels on the railway, in the reverse direction, begin to recoil the rope that has been run out, and thus cause the carriage gradually to gain upon the train, till it can be attached to it as before, the gripe being liberated the instant previous to this act. I estimate the case as follows:—Suppose the velocity of the train to be 20 miles per hour, or about 30 feet per second; let the drum be 1 foot in diameter and 3 feet long within its flanges; let the rope be half an inch in diameter, (for there should be little stress upon it at any time), and suppose the drum to receive one coil the whole length, and one overlap only, this would take up 150 yards, and thus admit the train to advance that distance, which would occupy 15 seconds, or a quarter of a minute; a time sufficient to receive any one on to a stationary-carriage only one step from the ground, and to throw in any luggage he could convey on foot. To prevent accidents, the end of the rope should only be slightly attached to the drum, so that if any accidental delay permitted the whole coil to run out, the carriage would be left stationary behind the train, which, of course, must then stop to adjust matters, as in any other accidental occurrence.

As a fall of 16 feet would generate about the same velocity as the ordinary speed of the rail-carriages, perhaps active persons might be set down by some modification of the principle of the common swing, attached to a boom over the side, with some convenient elevated point from which they could in their descent destroy all the momentum they had acquired as passengers, and thus step on the ground deprived of any velocity, and, of course, without injury. I merely state the principle; in practice it may be difficult to render this plan sufficiently safe.

I cannot conclude this paper, already too long, without remonstrating against the practice of permitting railways to cross common roads or paths at the same level. The Legislature ought to compel the proprietors to make bridges for every road or path crossed by railways.

If the wear and tear of railway conveyance be found too expensive, owing to the friction caused by such high pressure and great velocity, and that the use of springs to these carriages are not sufficient to remedy this evil—I think it probable that a dove-tailed groove, filled with hard oak, driven in in small pieces endwise, within the rim of the wheels, and then turned in a lathe till circular, might be serviceable, and could be cheaply renewed; these pieces might be secured in their bed by a fox-wedge, as commonly practised in similar cases (see F, fig. 6.)

I ought to apologise for giving you so many unripened suggestions, but the only choice of any of them becoming useful is by my thus submitting them to the consideration of operative mechanics.

George Cayley.

Brompton, Dec. 5, 1830.

THE PRINCIPLES OF LOCOMOTION.

> "Nothing can be proved but by supposing something intuitively known, and evident without proof."
> Dr. Johnson.

Sir,—I said in a former communication (No. 397, p. 45) that I could only prove the 5th proposition of my locomotive theory by a roundabout way (I did not intend a pun), and as no better proof has hitherto appeared, I send you my own, for the examination of your readers, in order that any doubt respecting the correctness of any of my propositions may be removed, previously to my founding my theory of locomotion upon them. And I here take occasion to remark, that I shall not feel myself bound to answer mere thoughts and opinions, such as Sivado's, in p. 464, vol. 14, but only attempt to prove my statements erroneous, which attempts may probably give me a ready means of establishing my assertions, as was the case in my answer to one of your correspondents, in No. 399, page 75. It may be argued, that, as I have asserted things which are new, I am bound to prove the truth of them; and so in the end I am, when I know what value to set on the opinions of those who question my statements. In the interim, I claim the courtesy mentioned by Johnson, that "he who tells nothing exceeding the bounds of probability, has a right to demand that they should believe him who cannot contradict him."

Locomotion being a new science, and having no set of defined laws, I can only proceed to proof of its principles by deductions from old and well-known principles of other sciences, applied (though probably by a very circuitous process) to establish the laws of this new science. I may safely assume the following as a truth recognized by many well-known laws and operations of nature and art. There cannot be advancing motion produced by any machine, animate or inanimate, unless the power attempting to produce such motion can ply against an abutment or fulcrum, that is either immoveable or much more slowly moveable than such power of advancing motion.* A bird cannot fly in vacuo; a fish cannot swim in air; a man cannot walk on water: so, if the constructor of any locomotive-machine attempt to make a locomotive fulcrum within the machine itself, that fulcrum being always moveable with, and at the same rate, as the machine, the attempt will fail—no advancing motion can be produced; but locomotive machines are made and do advance—therefore, their power must ply against something not in themselves; and as it is not in the air, it must be on the ground. Now, as they only touch the ground in points of lines tangent to their wheels, therefore the constant or variable point of contact with the ground, is the constant or variable fulcrum or abutment of the advancing motion. This I consider a sufficient proof of the correctness of the latter part of my 8th proposition, "That a stone under a moving wheel becomes a fulcrum, over which the moving weight is to be lifted." Some have doubted its being a fulcrum. The proper fulcrum of common rotative motion is the axle of the wheel; the fulcrum of locomotion is the ground. I think I may also safely assume, that howsoever or in whatever line of direction a mechanical power may appear to act, still its only real or effective maximum force is in that line of direction which is opposed to the immoveable fulcrum or abutment, which forms the base or re-action of that power, as will more clearly appear on removing that base. To those who admit this assumption, no other proof of the correctness of my 5th proposition will be necessary. As the ground is the fulcrum of locomotive power, and the line of gravity, the maximum line of direction of any force or power opposed to the ground, therefore the line of gravity is the line of direction of the greatest locomotive power. But, as this assumption may not be admitted by many, I must proceed to try other modes of proof.

Let PL, in figures 1, 2, 3, 4, 5, represent a plane, A a loaded frame, B a support and pulley fixed to the plane or other moveable place, and W a weight. In figures 1, 2, 3, advancing motion will be produced in the frame A, if the weight W be sufficient to overcome the friction between the plane and the frame, because the fulcrum or abutment of the power W is in the immoveable prop B; and although the line of direction in which the power appears ultimately to act is varied three ways, yet its action in reality is only in that line directly opposed to the prop or support B, whose abutment is the immovable ground of which it may be said to form a part. This is common motion, true at sight, needing no proof except reference to a common sledge. The same effect will take place if the frame be mounted on wheels, as in fig. 4, but the friction will be less, requiring a less weight. This is also common motion, such as a horse drawing a cart. If the arrangement be made like figure 5, the frame A will still advance until W be perpendicular under some part of it. This shows that common motion will produce an advance so long as the line of direction of the moving power deviates any little from the perpendicular; but were the prop B taken away, the weight would come to the perpendicular at once, and no advancing motion could take place; so that without B be fixed, or relatively so, advancing motion cannot take place at all. Now, if the prop or fulcrum B, be placed on the frame A, as in figures 6, 7, 8, 9, it will be equally moveable with the frame; therefore, as before stated, the weight W will produce no attempt at advancing motion; if it would, this would be locomotion. I presume it will not be contended, by any one conversant with the science of motion, that any, even the weakest efforts at advancing motion can be made by any of the frames, although the line of direction of the motive power is shown as acting in appearance four different ways, down, up, forward, and backward, yet it only really acts or is efficient in the line opposed to the immoveable abutment, which is the ground. There is certainly an increased friction on the plane, but that does not alter the possibility, or rather impossibility—it only requires an increased power. Nor will the mere mounting the frames on wheels give them that tendency to advancing motion which they had not before—it will only lessen the friction; it cannot cause locomotion, because, as before proved, the fulcrum is still as moveable as the frame. Now, although the weight cannot produce advancing motion in the frame, like as a man standing in a boat, cannot by either pushing or pulling at the boat produce any advancing motion in it, unless he ply at an abutment out of the boat, yet he can produce motion in any thing loose within the boat, whose proper individual fulcrum is in and fast to the boat, such as lifting a weight, drawing a nail, moving a hinge, bending a spring, or turning a wheel; just so can the weight W produce motion in any loose thing, or one fastened only by a part of itself to the frame A, and if by operating on any such loose parts the frame can be made to advance, it will become a locomotive machine. Now, it has been discovered, and is known in practice, that such motion in the frame may be effected by operating on wheels bearing the frame, by endeavouring to turn such wheels round against the immovable fulcrum the ground, and without such an immovable fulcrum, I have before proved it is impossible to produce advancing motion. Let us enquire more particularly how this is effected.

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* I once thought the following might be objected against this general rule. Suppose a rope upon a windlass be fast to one carriage, and the other end of the rope be attached to another carriage, then a person in one carriage working the windlass could make the carriages approach each other; but in this case, the carriages become a fulcrum to each other, and whilst the rope moves the whole distance, each carriage only moves half the distance. In fine, these would not strictly be locomotive-machines of the nature we are treating of.

Figures 10, 11, 12, 13, represent the loaded frames mounted on wheels, with the power-springs fastened in various ways to what I here call moveable appendages, namely, to the wheels, by means of pulley-grooves instead of to the fast frames. It will be observed, that the line of direction of the power on the wheels is in appearance in every extreme variation of direction, yet, as before, its only real line of effective direction is that which is opposed to the ground, or fig. 10. Now, if the frames and wheels be lifted off the ground or plane, and the frames held fast, every large wheel (being of one size) will be turned round by like weights with the same velocity (disregarding pulley friction) and any pressure against any part of their rims will alike retard their motion. It is immaterial to the motion in what line of direction the power acts; there is no resistance in one direction more than another: it will be a tangent to the circumference any way, and bear the same relative situation to the axle, which is now the fulcrum, and immovably fast to that which supports it from the ground. The pulleys, over which the strings in figures 11, 12, 13, pass, may also be considered as fixed to that which supports them from the ground; and, therefore, the pulley next to each wheel becomes, for the time, an immovable abutment opposed to that wheel. Nor is it material to what part of the rim any hindrance is applied, because no place can ever vary the propor-

Fig. 1.

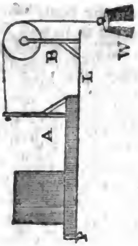


Fig. 2.

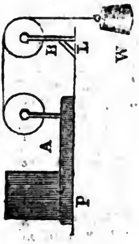


Fig. 3.

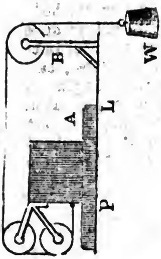


Fig. 4.

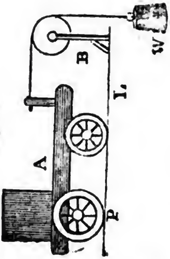


Fig. 5.

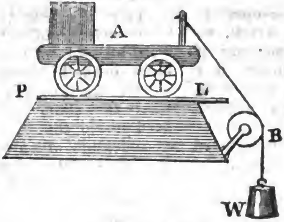


Fig. 6.

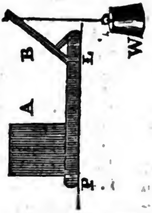


Fig. 7.

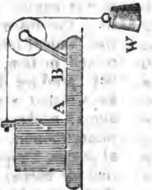


Fig. 8.

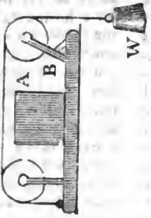


Fig. 9.

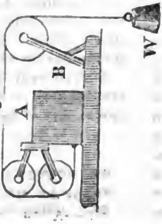


Fig. 10.

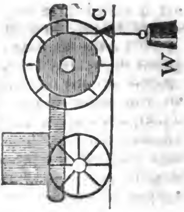


Fig. 11.

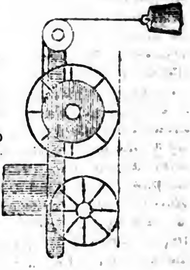


Fig. 12.

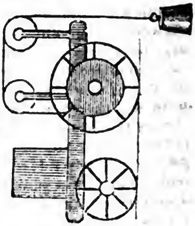
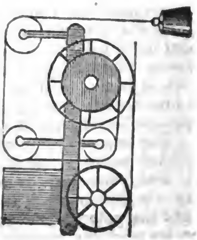


Fig. 13.



tion of leverage (from the fulcrum) of the power and resistance, Therefore, the power of figure 10 is the measure of the power of any of the others; that which will move figure 10 will move any other, and that which will stop figure 10 will stop any other.

But as any power whatsoever, whether it be gravity or elasticity, or mechanic force, applied to turn one of these wheels, (when off the ground) must be applied in a line of direction at or between some one of the extremes before mentioned, as these extremes include the whole circumference, it follows that fig. 10, which represents gravity only, is a true measure of every other power possessing the same quantum of impulsive force. Therefore, any mechanical power, suppose equal to 100lbs., trying to turn a wheel round is only equal in force to 100lbs. weight, hung by a line on a horizontal spoke of the wheel, at the place where the mechanical power is applied to that wheel. This proves my 5th proposition, as far as regards *turning* the wheel: now for "starting it forward." Let the frames and wheels be placed on the ground or a plane, with the weights free to act as before, the weights will still make the *same efforts* to turn the wheels round, but the pressure of the rims of the wheels against the ground which is now the only immoveable abutment, will create a certain hindrance, by which a different effect will be produced. If this hindrance amount to more than that which keeps the frames and axles stationary, the wheels will be at liberty to roll forward and carry the frames and axles with them; for a wheel is capable of sustaining two motions, namely, round its axle and along a plane at the same time. But it is well known and needs no proof, that this hindrance is, under some circumstances, much more than that which keeps the frames and axles stationary. It has been proved on the rail roads, that the hindrance to the advance of a ton weight forward is not more than 20lbs., whilst it may safely be assumed, that the hindrance to turning the wheels round without advancing, is more than 200lbs. The wheels will consequently yield in that point, or line of least resistance, and when such resistance is less than the hindrance between the wheels and the ground, rotation and locomotion are produced together. It follows also, of course, that when by means of obstacles or hills, the hindrances forward amount to more than the hindrance beneath, locomotion ceases, the wheels can more readily turn round where they stand than advance. It has been proved, that figure 10 may be taken as a measure of any other power of like amount, and that what would stop figure 10 would stop any other like power borne by the wheel, or when the wheel is off the ground; and it has been proved, that an obstacle may occur that will cause locomotion to cease. Now, I think, the fast obstacle represented by C in fig. 10, would cause locomotion to cease. I think it needs no proof, that the weight W, however great, could never raise the frame and wheel over C; the wheel would rather turn round where it stands. I take it to be evident to a mechanic, at first sight; and if W could not raise it, I have proved that no other locomotive power could, as it has also been proved, that the force of a weight and other mechanical force, are alike in producing rotary motion, and that rotary motion will produce locomotion. Now, it is known that a weight hung on the horizontal spoke of a wheel will produce rotary motion. Therefore, "a mechanical power, suppose equal to 100lbs., carried (or borne) by a wheel and trying to start that wheel forward is only equal in force to 100lbs. weight, hung by a line on a horizontal spoke of the wheel, at the place where the mechanical power is applied to that wheel," which was to be proved. I have arrived at this conclusion by a very "roundabout" process, but I believe the positions are all true, and it is the best I can give at present. I have taken many things for granted, because I believe those who are capable of pursuing this investigation, will at once allow them without proof. And if it be thought by any one, that I have not sufficiently proved my proposition, still I think I have furnished a clue to the means by which it may be proved.

I shall next proceed to apply my 12 propositions to the establishment of my new theory of locomotion; and remain,

SAXULA.

MR. GURNEY'S STEAM-CARRIAGE—REMARKS ON MR. HERAPATH'S LETTER.

Sir,—Allow me space for a few remarks on Mr. Herapath's letter (p. 123), which I feel called upon to make, being one of those persons who have publicly and repeatedly asserted, that Mr. Gurney's steam-carriage cannot go up hill, (see vol. xiii. page 221). I still assert the same, unless it has been rebuilt on different principles. By up hill, I mean such hills of common roads as horses draw carriages up, the test of which is passing over a one or two inch bar on level ground, at a dead pull, or a pull without momentum. Mr. Gurney and his supporters have done wonders in persevering so far as to show, that steam-carriages can run and draw a load at the rate of 9 or 10 miles an hour on a common level road, and I hope they will receive from the public the thanks, and more substantial remuneration, which they richly merit; but let them not try to palm upon us things as possible, which I believe they know practically to be impossibilities. Why else send the carriage to the "extremely level road" (as another account says) at Cheltenham? I stoutly maintain, and hope soon to prove, that it is impossible for any locomotive power applied to a 9-inch radius crank upon the axle of Mr. Gurney's carriage-wheels to propel his carriage up hill, that is over a 1 or 2-inch bar as mentioned. The line of direction of horse-power is *parallel*, or nearly, with a level road; the line of direction of mechanical locomotive power is *perpendicular*, or nearly, to a level road—'tis this renders it impossible; if Mr. H. can disprove this, I am silent; but this admitted, the impossibility follows of course.

Mr. H. says, all the curious properties of steam-carriages, mentioned in his letter to the Duke of Wellington, have been amply verified by experiments. What, all! That curious property, among others, of climbing a hill rising "one foot in about two feet," or 18 inches at a yard! (Mr. Gurney's letter, p. 18).—This beats me hollow, and I have been a great swaggerer about climbing. My new theory says it is *possible* to make a steam-carriage on plain wheels ascend an inclined plane rising 12 inches at every yard, but it must be by having a constant steam-pressure equal to nearly the whole weight of the machine, upon cranks nearly equal in radius to the wheels (see vol. xiii., page 410). The truth is, Mr. Herapath had not a sufficiency of experimental data to found his mathematical theory upon. I hope he will excuse my saying, it is for the most part mathematical twaddle—a glimmering of light in a region of darkness;—the premises are wrong. It is trifling with his own talents, and the public feeling, to make a display about stopping, and backing, and turning, and warming in winter by the same fire which is insensible in summer, when the main and original difficulty stands unremoved. That such a difficulty, a gross error in principle too, does exist, is plain; else why cannot six steam-horses draw the carriage over an obstacle that one living horse can draw it over? Such errors do not occur in other machinery.

Let the patent cranks * or gearing of 2½ or 3, or more feet radius, be tried; lay plenty of the weight on the hind wheels, and many of the present difficulties will vanish (not all)—and let those difficulties be fairly stated, and not concealed or glossed over, and then, I doubt not, there is an abundance of talent that will come forward, as was the case at the eruption in the Thames Tunnel, to point out means of removing such difficulties, and accomplishing this great "national object" as far as the state of practical mechanics will admit; and that is no imperfect state in the present day.

Yours, &c. SAXULA.

April 26, 1831.

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THE GRAND SCIENTIFIC MEETING AT YORK.

Sir,—If it be really the fact that arrangements are now making at York for a grand scientific meeting, on the plan of the German Assembly of Inquirers into Nature, I cannot help wondering at the extreme folly of the projectors. Pray what is it that has occasioned these so much talked-of meetings in Germany, but the want of a common metropolis? Wherever the cultivators of science are scattered over such a wide extent of territory, that to have an opportunity of forming an acquaintance with them all, one must traverse the whole land from north to south, and from east to west—there an assembly, such as has been established, may be of some use. But, in the capitals of England and France, assemblies of this kind have already been in existence for some hundreds of years, and have the additional advantage of being permanent; for who is there distinguished for science or any thing else in those two countries, who does not, true as the needle to the pole, direct his course to London and Paris? To attempt to establish a scientific assembly on the German plan, in either of these two countries, is to light a farthing rushlight in the blaze of noon. The projected meeting at York will, of course, prove a failure. Indeed, I never heard of a more foolish project, save one, which was indeed a cousin-german of the present, namely, that for establishing a book-fair in England, on the plan of the celebrated one at Leipsic.—Yours, &c.

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* The writer means, it is presumed, those of Mr. Clive.—ED. M. M.

A. C. C.

May 2, 1831.

PS.—I have said above, that a meeting on the German plan *may*, in such a country as Germany, be of some use. But I have long suspected that it is, as at present organized, something of what is expressively called a *humbug*; and my suspicions have been confirmed, by the account of the last anniversary in the April number of Dr. Brewster's Journal. The writer, Mr. Johnston, to whom the readers of that work are indebted for almost all its entertaining articles, observes, that in the earlier stages of the establishment, when only a few scientific men assembled (and when, of course, the stated object of collecting together *all* the naturalists of Germany, was far from being attained), it furnished, as he has been informed, a high intellectual treat; but, he adds, from his own experience, that now, when its professed objects are secured, it presents a mere scientific mob, crowded together for no visible purpose, as neither can new acquaintances be formed nor rational conversation enjoyed.

Yours, &c.
A. C. C.

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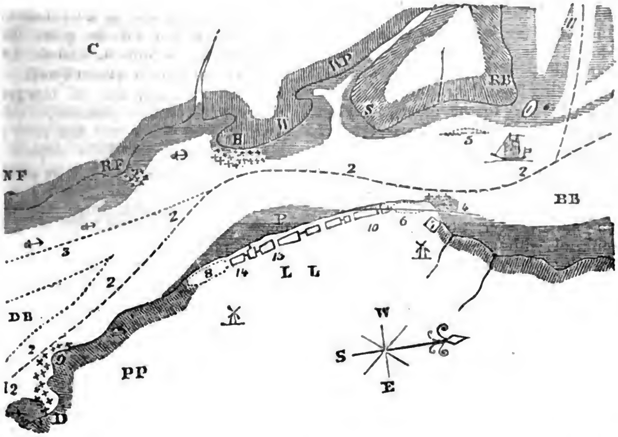
REMARKS ON THE PROBABLE CAUSE OF PLUCKINGTON SAND-BANK OPPOSITE THE DOCKS AT LIVERPOOL.



Sir,—I trust the importance of the subject of which I shall presently treat, will secure it a place in your valuable columns; and I have only to regret, that it has not hitherto engaged the attention of some person here, who could do it more justice than I can; as the sand bank in question has risen to such an alarming height, that it is extremely dangerous for large vessels to go into or come out of the docks adjoining. Many vessels going to sea have grounded upon it, and been obliged to put back and discharge their cargoes, and undergo heavy repairs.

The prefixed rough sketch of the estuary of the Mersey and the adjacent shores of Lancashire and Cheshire, may serve to help us both to the cause of this obstruction and to its remedy. LL, denote the situation of Liverpool; P, Pluckington Sand-Bank; B B, Bootle Bay; D, the Dingle; D B, Devil's Bank; PP, Potteries; NF, New Ferry; R F, Rock Ferry; B, Birkenhead; W, Woodside; WP, Pool; S, Seacombe; R B, Rock Battery. No. 1, the Rock Light-house; 2, shows the direction of the tide; 3, an inferior current separated from the main stream; 4, Mile-house Rocks; 5, Rip Raps, sand bank not dry; 6, New North Docks; 7, Fort; 8, New South Docks; 9, Rocks at the Dingle; 10, Prince's Docks; 11, Rock Channel; 12, Formby Channel; 13, King's Dock; 14, Queen's Dock.

I will now venture to state, what I take to be the cause of the impediments that have arisen of late to the navigation of the river; I will begin first with the setting-in of the tide. Two currents coming from the sea, as represented by the dotted lines in the engraving, join opposite the Rock Battery; from whence, both deviating from their intended course (each giving way to the other), they set strong upon the Mile-house Rocks, thereby forming an *eddy* on the Cheshire side of the Rock Battery, where there is a small *sand bank*, denominated the Rip Raps. The Mile-house Rocks then repel the tide, which makes over to Woodside and Birkenhead with great rapidity—consequently another eddy, more serious than the first, is formed on the Lancashire side of the river, and another sand bank created, called Pluckington, which has been always in existence, but not to such a dangerous extent as at present. This bank is dry long before low water; the Rip Raps are always covered. The tide having now come up to Birkenhead, recoils from the Cheshire shore to the rocks at the Dingle, where the river suddenly expands, and sand banks and shallow water begins. I may remark, that in the above track of the current, the bed of the river is the deepest. The narrowest part of the river is opposite Seacombe, where it is about three quarters of a mile across; and the broadest part is about thirteen miles up the river, where it is five miles wide. Therefore, the Mersey may be compared to a bottle, which a muddy current enters with great force at the neck, but afterwards expands in the body of the bottle, where its strength is lost and the sediments deposited.

Since the Prince's Dock has been finished, but particularly the North Docks, Pluckington has risen in height, and extended itself farther into the river, opposite the King's, Queen's, and South Docks. Opposite the latter was a great portion of deep water, which is now filled up with sand. This is owing to the North Docks being forced out to the edge of low water-mark, which has narrowed the mouth of the river, and kept out a portion of the tidal waters, that are pressing from without to gain admittance. This is borne out by the observations of some surveyors from London, who came here some years since to obviate these impediments if possible. They found the water in the Rock Channel considerably higher than that in the river, and proposed, as a remedy for the sand banks, that all the piers, the sea wall as it is termed, should form a straight line from North to South.

I must mention, that of late years it has been a constant practice, to take six or eight mud boats into the river every day, and there let them deposit their cargoes, which, I think, is a great aggravation of the evil. Each boat will carry, I should think, from forty to fifty tons.

The remedy I propose, is this:—to *widen* the *neck* of the river, so as to allow the water ingress, and let Nature have her own way, and *assist*, rather than *curb* her. In the accompanying sketch is represented a demarcation line from the South end of the Prince's Dock to the foot of the Fort. All the works now erected outside this line I would instantly demolish, and take away the ground to the depth of low water, and make the future docks out of the *land*—not as heretofore, gain all from the river. This would not only give admittance to the usual quantity of water that formerly came in, before the North Docks were made, but would admit a *greater body* into the upper part of the river han ever came in before, which would deepen the shallow channels above the town.

The corporation who claim to be conservators of the river, have of late years been at law with different companies that have made encroachments in the upper part of the river, thereby diminishing the back water that is in the inlets, which, they say, keeps the channels open. This is the case to a *certain* degree; but the Corporation do not observe, that whilst they are making the mouth of the river narrower, they are *diminishing* the back water.

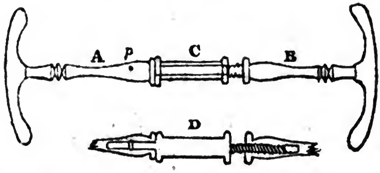
I think the plan I propose, would confine the current more to the Lancashire side of the river, and not give it such a check at the Mile-house Rocks; therefore Pluckington would decrease very fast, and allow a proper entrance into the King's and South Docks.

The objections I anticipate to this plan being carried into effect, would be, that the forward state of the works would render it most expensive, and the Corporation would then have to purchase land for the new docks. All this I admit—but it is better to begin now, before the land is built upon, for when that takes place, it will be treble the value at present, or more than that. "An expensive cure is better than none."

Yours, &c. T. S.

Liverpool, February, 1831.

IMPROVED HAT STICK.



Sir,—Perhaps my present communication may, from the extreme simplicity of the subject, excite the risible faculties of some of your readers; nevertheless, I am of opinion, there are very few of them who would despise the convenience that may be afforded by an improvement in so humble an instrument as the common hat-stick.

The above drawing represents a hat-stick, composed of three parts; viz. the two ends A and B, and the centre-piece C. The end A is perforated to a depth of one and a half or two inches; the end B is perforated and tapped with a female screw. The centre-piece C, has at one end a plain cylindrical projection—at the other, a male screw. The plain cylindrical piece has a groove in which a pin P works, and prevents it from drawing out, while the lengthening of the stick is regulated by the action of the screw. This part of the arrangement will be made clearer by reference to the section D.

In using the hat-stick or stretcher, it may be placed in the hat, and afterwards adjusted to any degree of tightness that may be required, by turning round the centre-piece C, which is made either square or octagonal for the convenience of grasping. In this stick, any portion of a revolution can be given to the screw, whereas, in those of the ordinary kind, less than half a turn cannot be made, and, as the screw is usually of a coarse thread, some inconvenience thus arises; besides such sticks require to be adjusted previous to placing them in the hat, in doing which, as well as in the withdrawing, the lining is much discomposed, &c.

But I have no doubt, that enough has been said to render my plan intelligible to all your readers; and although the instrument itself, and the improvement now suggested, are both of the simplest description, still I am of opinion that no apology is necessary for its appearance in the pages of the Mechanics' Magazine.

Any turner may make one, and any person having a hat can use one, and all who use it will readily discover and duly appreciate its several good qualities.—Yours, &c.

WILLIAM BADDELEY.

April 4th, 1831.

NATIONAL REPOSITORY—OPENING OF THE FOURTH EXHIBITION.

The fourth, and, to all appearance, the last exhibition of this Institution, opened on Thursday, the 28th ult. We have no inclination to exult over the failure of good intentions; and we shall, therefore, before proceeding with our report of the symptoms which indicate that the exotic thing is _in articulo mortis_, content ourselves with reminding our readers, that we have all along (for a time single handed) protested and predicted that it was an Institution wholly uncalled for by the state of the arts and manufactures of the country—and that it would never be supported to such an extent as to give it the least claim to the character which it so presumptuously assumed of being a "_National_" Exhibition by "_the_ Artisans and Manufacturers of the United Kingdom."

The _number_ of articles in this fourth annual show, seems at first sight, to be sure, prodigious; the catalogue specifies no less than _sixty_ separate and distinct things—sixty "new and improved productions," all brought forth in the course of one brief year! What _nation_ (if mere numbers were every thing) might not be proud of such a _national_ display? There are not many more than five hundred and fifty manufacturing towns in all England, Scotland, and Ireland, and here is actually one invention for every nine towns!!! The circumstance of nine towns clubbing their wits to produce a something new—a new stay-lace or a new bodkin, for example—may possibly put some people in mind of nine tailors uniting to form one human identity: but far be from us, the illiberality and impertinence of insisting on so disparaging a comparison. True it is, however—and truth requires the fact should be stated—that of these sixty "new and improved productions," at least eight (the models in clay, Nos. 2, 3, 4, 5, 6, 7, and 8, and the stuffed birds, No. 23) are _not_ productions of "_the_ Artisans or Manufacturers of the United Kingdom," or any of them, but of foreigners; that four others (No. 21, 27, 28, 47) consist of scissor-and-pencil work by certain young _Misses_ of the Minories and the Gravel Pits, who have no legitimate claim to rank among the sons of industry and toil; and that, independently of the objection to this dozen of articles on personal grounds, neither models in clay of men and beasts, nor stuffed parrots and jackdaws, nor artificial flowers by young Misses ("pretty imitations," though they be "of Nature's works," according to the affected phraseology of the Catalogue), are exactly such productions as one would look for in an exhibition by a great nation of its improvements _in arts and manufactures_. It must be confessed, too, that there is a _little_ latitude of construction indulged in, when mere specimens of skill in drawing and paper-modelling (Nos. 43, 44, 45, 57), methods of teaching "the young idea how to shoot" (Nos. 17, 58,—schoolmasters' puffs, perchance), common plaister busts (Nos. 11, 25), and ordinary likenesses in wax (Nos. 12, 13), are classed as "new and improved productions" of the artisans and manufacturers of the United Kingdom. Now, if we deduct these various excepted articles—twenty-two in number—as, in fairness, we ought to deduct every thing that has nothing to do in an exhibition of this sort—there will be but thirty-eight specimens remaining to represent the state of manufacturing skill in Great Britain and Ireland for the year 1830-31! And that, according to Cocker, gives to each of the five hundred and fifty towns little more than a fourteenth part of an unit's share in the glory of the present (pseudo) _national_ exhibition!!! What may we not call _national_ after this?

Let us next see of what sort the "new and improved productions" are, of which this paltry residue of thirty-eight is made up. We have:—

*1 Model of a Patent Suspension Safety-Coach.—_Stafford_.
*1 Portable Shower-Bath.—_Machell_.
2 Models of Paddle-Wheels.—*_Murdock; Sandys_.
2 Models of Fire-Escapes.—_Walker; Bunnet_.
1 Portable Garden-Chair.—_Dale_.
*1 Specimen of Granulated Grounding on Copper or Steel for Engravings.—_Russel_.
1 Filtering Apparatus.—_Yrigoiti and Williams_.
1 Specimen of Printing in Colours. _Edwards_.
1 Specimen of Brass Rule Printing.—_Parkes_.
1 Specimen of English Straw Platting.—_Vyse_.
1 Recumbent-Chair.—_Topliffe_.
4 Flageolets.—_Bainbridge_.
1 Case of Specimens of Artificial Eyes.—_Grey_.
*3 Brickmaking Machines.—_Bakewell_.

1 Spring Tape-Measure.—*Chesterman.*
*1 Specimen of Fine Silk Hosiery.—*Pope and Co.*
1 Set of Fine Porcelain.—*Bramfield and Co.*
*1 Model of a Ship's Rudder.—*Brooking.*
1 Improved Key Fid for striking Topmasts.—*Ibid.*
*1 Specimen of Diagonal Seaming for Ships' Sails.—*Ibid.*
1 Specimen of Embossed and Stained Glass.—*Hudson.*
*1 Rug of Irish Manufacture.—*Roberts.*
1 Percussion Grenade Rifle-Ball.—*Norton.*
1 Model of a Condensing Steam-Engine.—*Bather.*
1 Mill for Crushing Sugars.—*Appleby.*
1 Hay and Straw Cutting-Machine.—*Ibid.*
1 Corn-Mill.—*Ibid.*
1 Mill for Crushing Rape and Linseed Cake.—*Ibid.*
1 Pamphlet-Preserver.—*Hawkins.*
1 Steel Cylinder for Setting Razors.—*Coleman.*
1 Specimen of Painted Muslin Window-Blinds.—*Simpson.*

38

Now, is not this a rare collection? Worthy of the first nation in the world! Worthy of having for its "Patron" the Sovereign of the first nation in the world? Worthy of the "Board" of Noblemen and Gentlemen by whose "management" it has been brought together? Worthy of the men of science and mechanics who compose the "Committee of Inspection," appointed to guard the portals of this precious Repository? And, above all, worthy of being seen by all the world at a shilling per head? Why, there is scarcely a street in the metropolis so mean and beggarly, but that you may find some shop or other in it, that you may visit for nothing and welcome, where you shall see specimens of mechanical skill, far exceeding, both in novelty and merit, any thing which this Institution, with all its apparatus of patronage and direction, and all the puffing there has been about it, can boast of. Any one of the Bazaars, the admission to which is free to every body, is worth a dozen such shows as this. Of the thirty-eight articles which we have placed to the credit of the establishment, more than one-half are unworthy of notice, and do not receive any even from the Managers themselves in their official catalogue; and of the rest there are but eleven which have been thought to possess importance enough to justify a particular exposition of their merits. We have marked the eleven with asterisks, and, in justice to the inventors of them, we shall here extract what the "Committee of Inspection" have reported concerning them:—

Stafford's Suspension Safety-Coach.

"This mode of suspension has very decided advantages, and must contribute essentially to the security of carriage travelling. The body of the coach is supported by two uprights, which rise from the bed of the carriage over the middle of each axle-tree. Each of these uprights has at its top a transverse piece, the upper surface of which is curved. On these curved surfaces rest similar cross pieces, curved on their under surfaces, and held in their places by steady pins, and connected, by the intervention of elliptical springs, with the upper part of the body of the coach. The springs here introduced break the concussions as in other spring-mounted vehicles; but the peculiar advantage of the arrangement ingeniously adopted by Mr. Stafford is, that whenever the wheels by any inequalities or construction of the road are thrown upon a plane inclining laterally, the two curved surfaces, on which contact is maintained betwixt the body of the coach and its supporters, roll on each other, and the points of contact are removed towards the side of the rising wheels, by which the vertical line of gravity is preserved nearer than it otherwise would be to the central point within the supporters, in this case the wheels. The body of the coach, being supported on a line considerably above its centre of gravity, has no tendency to lean over with the changes of inclination in the position of the wheels, but in all cases, when properly loaded, will maintain its perpendicularity, and thus relieve the passengers from a sense of danger, which in many instances leads to groundless alarm, frequently inducing calamitous results.

"No man of mechanical knowledge can look at the preposterously-laden public vehicles which crowd our roads, without speculating on the risk of human life incurred. He will hail with delight every new effort of science to curb the mischiefs which ignorance, spurred by avarice, is hourly provoking."

(To be concluded in our next.)

CAPTAIN NORTON'S RIFLE SHELL.

Sir,—I feel obliged for the notice you have taken of my invention in your very useful and universally-circulated Magazine. There has been an omission made, however, in transcribing the last paragraph of the extract from the United Service Journal, which renders the sense unintelligible. After the words "within it" (p. 88, col. 1, l. 12) there should have been added, *yet a mould may be made without having a section of the rifled barrel inserted in it.* In this case, &c., &c. There is a report in the United Service Journal of this month, by an eye-witness, of an experiment made by me at Notting Hill, before the Master-General of the Ordnance and several other officers. The experiments I made at Woolwich, in the spring of 1826, were from a rifle a size larger than the military one; at the distance of one hundred and twenty yards, I fired twelve shells against a large deal target, about an inch thick, every shell struck on its percussion cap, and, I have every reason to think, each shell exploded, but there was nothing behind the target to show the effect. Many ingenious contrivances have been devised to cause a ball to strike on a given point, but no method has as yet been discovered, that I am aware of, to cause a *naked* ball to strike on any given point of it, otherwise than by discharging it from a rifle.

Yours, &c.
JOHN NORTON.

14, *St. Alban's Place, 4th May*, 1831.

[The following is the report in the United Service Journal of this month, to which Captain Norton alludes in the above letter: "We were witness to an experiment made by Captain Norton, at Moore's Shooting-ground, Notting-hill, with his percussion rifle-shell, on the 23d. ult., before the Master-General of the Ordnance, Major-General Sir Andrew Barnard, Major-General Norcott, Colonel Fox, and several other officers. The result was quite satisfactory, as proving the utility of these projectiles. The object fired at was a small box, of about a foot square, its front being of oak, one inch in thickness, and back of elm, of an inch and quarter; between these was an enclosed space of one inch filled with powder. The shell was discharged from a military regulator rifle, having the head of its ramrod hollowed out to prevent pressure on the percussion cap; the distance about fifty yards. The first and second shots missed the objects, and the shells passed clear through a broad iron plate, which clamped together a three-inch boarded screen, against which the experiments were made. The third discharge carried the shell clear through the box, and caused an instant explosion.

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MINOR CORRESPONDENCE.

Application of Paddle-Wheels to Wherries.—Sir, Amongst your numerous correspondents there are doubtless some acquainted with the results of the experiments made at different times during the last few years on the River, with paddle-wheels applied to the common wherry. I wish to know what power a man was found to have with the paddles, compared to what he has with a pair of sculls, whether more or less; and whether the power was applied direct to the axle of the paddle-wheels, or their speed increased or diminished by means of a connecting-band, or wheel and pinion; likewise, the size of the paddle-wheels. To any one who will favour me with such information, through the medium of your Magazine, I shall feel much obliged; and am, Sir, your obedient servant, A LOVER OF AQUATICS, *April* 26, 1831.

Gurney's Steam-Carriage.—Sir, Accounts have appeared stating, that a steam carriage of Mr. Gurney's construction runs regularly between Cheltenham and Gloucester, and that it performs the distance in a few minutes; while others assert, that it travels quite as slowly as the regular stage. If any of the Gloucester or Cheltenham readers of the Mechanics' Magazine would be so good as to send an account of its real performances, he would oblige many besides your obedient servant, F. H. *May* 3, 1831.

P. S.—Why does not Mr. G., if he has succeeded in obviating all difficulties, run a carriage in the neighbourhood of the *metropolis!*

◆

Conversation at a Distance.—One of the poets has put into the mouth of a *madman* a petition to the gods to "annihilate both time and space." But the object of the prayer seems almost to have been realized, in sober earnest, on the Liverpool Rail-road, the miraculous powers of which we are now more than ever unable to anticipate. It is now proposed that a tube shall be carried along the course of the rail-road, through which a conversation between Liverpool and Manchester may be carried on!—*Monthly Review.*

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INTERIM NOTICES.

A. T. B.—A letter without fail on Saturday.

The first mathematical question, vol. xii. p. 13, respecting which Skyoblum makes inquiry, has not yet been correctly solved by any of our correspondents.

Communications received from Mr. Tonkin—Henry D—Mr. Ettrick—Mr. Hindmarsh—Mr. Baddeley—Von Egmont—Mr. Mackinnon—Σ.—Mr. Todd—Trebor Valentine—An Apiarian—R. M.

LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street, where Communications (post paid) are requested to be addressed.

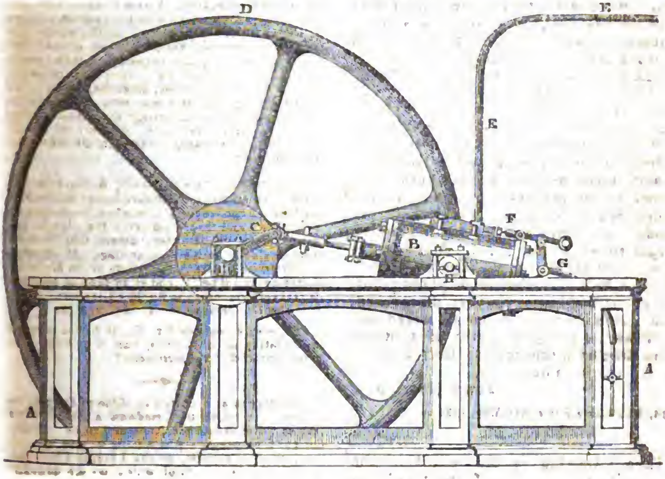
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 405.] SATURDAY, MAY 14, 1831. [Price 3*d*.

GURNEY'S HIGH-PRESSURE STEAM-ENGINE.



BADDELEY'S IMPROVED BALL-COCKS.

Fig. 1.

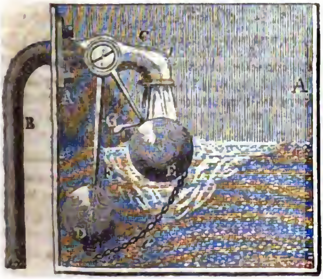
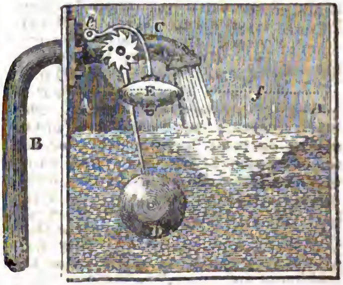


Fig. 2.



DESCRIPTION OF THE VARIOUS PRACTICAL MODIFICATIONS OF THE STEAM-ENGINE.

BY MR. C. DAVY.

(Continued from p. 114, vol. 15.)

GURNEY'S HIGH-PRESSURE ENGINE.

Sir,—An attention to the different arrangements that have been devised for the improvement of the steam-engine, would lead us to infer that engineers have chiefly aimed at reducing the space they were wont to occupy, and of necessity the number of working parts in their construction; and this it appears to have been generally thought, would be best effected by an application of the steam-power immediately to the fly-wheel. In most instances, however, considerable and unforeseen difficulties have arisen, to defeat what would otherwise have been the great desideratum. The engine represented on the preceding page is one of this class. The precise time of its invention I am unable to state accurately, but vibrating cylinders have been long known. In 1823, an engine with its cylinder on the vibrating principle, was employed at Dockhead, invented by a Mr. James Neville. It had (says the Editor of the Repertory) "its hollow gudgeons placed about the middle of the cylinder; its piston-rod passed out at top in the common direction, and the hollow gudgeons were contrived so as to act like cocks, in admitting or shutting off the steam, and in opening or closing the communication with the condenser; which latter ingenious invention very much simplified the machinery, since the mere vibration of the cylinder opened, and shut the communication as perfectly as the most complicated valve apparatus." It is affirmed, that *before* this time the same description of engine was well known in the vicinity of Liverpool. In August, 1827, Mr. Peter Burt, of Waterloo-place, Limehouse, mathematical instrument-maker, obtained a patent for a steam-engine on a similar principle. In fact, the only difference appears to have been, that the piston-rod in the latter engine passed out at the bottom instead of the top. Thus we see, through the present state of the patent laws, a grant may be obtained for a "mere alteration of the position of an engine," without the least improvement being effected by such an adjustment. In August, 1827, Mr. Maudslay obtained a patent for a steam-engine with a vibrating cylinder, but from the carelessness with which the specification was drawn up, it is impossible to determine whether it was an improvement or only a modification of those already patented (see Repertory, vol. 7, N. S. p. 183). Mr. Goldsworthy Gurney's engine, exhibited in the engraving, is measured and drawn from one used in his steam-coach factory, Albany-street, Regent's-park, and in common with all vibrating and rotary cylinders, the defects are—the utter impossibility of keeping the hollow gudgeons sufficiently steam-tight for any length of time, the unequal wear of the cylinder, the difficulty of lubricating the parts properly, and the necessity of using short cranks. The engines before-mentioned were upon the condensing principle; this of Mr. Gurney's is one of the high-pressure kind, and the steam is admitted to a slide valve on the top of the cylinder. The motion of the valve may be seen at once by inspecting the drawing.

AA represents the stand.
B cylinder.
C crank.
D fly wheel.
EE steam pipe.
F slide valve, &c.
G bent lever for parallel motion of slide valve rod.
HH plummer blocks.—Yours, &c.

C. DAVY.

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IMPROVED BALL-COCKS.

Sir,—It has frequently been noticed, as a defect in ball-cocks of the usual construction, that they begin to shut some time before the cistern is filled with water; the consequence of which is, that the last few inches of the cistern take more time to fill than would suffice to fill the cistern twice over if the cock was kept full open. It frequently happens in cisterns on a *high service*, that the supply is only kept at the necessary elevation for a short time; it is therefore highly desirable, in such cases, to keep the cock flush open until the cistern is filled; for if the water-way is contracted, the chance is, that the supply will be discontinued before the cistern can be filled. In buildings where there are several cisterns, at different elevations, it is also desirable to fill those on the lowest level as quickly as possible, because the water will not rise into the cisterns above, so long as any of the lower cocks remain open. Again, in situations where the water is not clear, and requires time to settle before it is fit for use, the quicker the cistern is filled the better, because the water will not subside so long as the cock is running.

These, and various similar cases which will occur to every reader, tend to prove the inconveniences attending the action of ball-cocks of the ordinary kind, and the benefits that might be expected from any alteration that would keep them open until the cistern was filled, and then allow them to close instantaneously.

Such an arrangement has been contrived by Mr. Joseph Farey, who, in the year 1817, submitted to the Society of Arts an improved ball-cock, as represented in fig. 1, (front page), for which the Society awarded him their silver Isis medal.

The peculiarities of this arrangement will be understood by the help of the accompanying drawing, where AA is the cistern; B, the service-pipe; C, the cock; D, is the ball and lever which is fixed to, and turns the plug; E, is a ball and lever put on a cylindrical part of the plug, free to turn on its axis without turning the plug. These two balls are connected together by a small chain *e*.

When the ball D is placed in this position, which is a little on the *left-hand* of the perpendicular dotted line F, it has a tendency, as the water rises, to keep the cock open. The ball E, on the contrary, is kept a little on the *right-hand* of the dotted line F, by the stop G, and consequently has a tendency to rise as high as the chain will permit, without altering the position of the plug or cock; but, as the water rises higher, the ball E pulls the ball D to the right-hand side of the perpendicular F, when the ball D immediately rises to the top of the water, and so shuts the cock.

Although there is much ingenuity displayed in this contrivance, yet there is one circumstance which materially limits its usefulness; which is, that the improvement does not come into action, unless the water in the cistern is low enough to allow the ball D to assume the perpendicular position.

In cisterns of a long shallow form, it is hardly possible to make a useful application of Mr. Farey's invention; for in very many of such cisterns, the ball does not assume the perpendicular until the cistern is just empty; and it happens, unfortunately, that it is cisterns of this description, in which the evils before complained of are most conspicuous, and the improved plan most especially desirable.

Ruminating upon these circumstances, I have been led to construct an improved ball-cock, to which the objections urged against Mr. Farey's will not apply. Fig. 2 represents the arrangement which I have adopted; AA, as before, is the cistern; B, the service-pipe; and C, the cock. D, is the ball-cock and lever fixed as usual to the plug; on the opposite end of the plug is fixed a ratchet-wheel. E, is a smaller ball and bent lever, hinged on the cock at *e*, and taking into the top of the ratchet-wheel, so as to prevent its turning in one direction.

The cistern having been nearly emptied of water, the ball D has sunk into the lowest position. The water is represented entering, and rising in the cistern; but the ball D cannot rise, in consequence of the lever E*e* preventing the ratchet-wheel and plug from turning. When the water has risen to the dotted line *f*, the ball E will be raised and the lever disengaged from the ratchet-wheel, when the ball D will instantly rise and shut off the water.

In this arrangement no impediment whatever is given to the falling of the ball D; but, *to whatever point it may have fallen, there it must continue, until the cistern is again filled with water.*

Yours, &c. WM. BADDELEY.

London, May 2, 1831.

DANGER OF SILVER DETONATING POWDER.

Some time ago, wishing to make a few silver detonating pellets, I put a small quantity of the powder with a little gum and powdered glass into a cup filled with water; the powder immediately sunk to the bottom, and while in the act of stirring it with a quill, in order to mix it thoroughly, it exploded with great violence, blackening the cup, but not breaking it. I mention this circumstance, as it may account for accidents "that have occurred, when the cause could not be traced." It is evident the powder is liable to explode, even in a liquid state, and therefore should be cautiously dealt with.—Yours, &c.

J. N.

THE CALCULATOR.

No. IV.

Description of a new Pocket Calculating Rule.

Sir,— In the prosecution of my inquiries into the extension of use, and the modifications of the sliding-rule, I have devised an arrangement which, it appears to me, will be eminently useful to surveyors, land agents, auctioneers, solicitors, and many other persons, for whose purposes the ordinary 12-inch rule possesses neither sufficient portability nor aptness.

This rule resembles Mr. Bevan's in breadth and thickness, and in the radius of its fundamental scales, but it is only *six inches long.* The method by which this great increase of compactness is attained is not new, being precisely that which enables the excise rules to be made 12 inches long instead of 24. The scales hereafter marked *a*, *d*, *f*, *g*, and *i*, correspond thus with the excise rule; all the other parts, except *k*, are filled with scales adapted to calculations of compound interest, and life contingencies. Such computations are of very frequent occurrence among the practical men above named, and I know not that any effectual attempt has as yet been made to enlist the sliding-rule into their service.

The 6-inch rule contains the following scales:

Stock.	First side.	Upper pt.	*a*	Common scale of numbers, radius 5·5 inches.
		Groove	*b*	Four scales, present values of annuities for years, at 3, 4, 5, and 6 per cent.
		Lower pt.	*c*	Four scales of equal parts, of which 39·52, 47·19, 58·71, and 77·90 are respectively equal to the radius of *a*. These are for compound interest, at the rates already mentioned.
	Second side.	Upper pt.	*d*	First half of a scale of numbers, 1 to 3·16—11 inches radius.
		Groove	*e*	Scale of areas of circular segments, and of polygons.
		Lower pt.	*f*	Second half of scale of numbers, 3·16 to 10.
Slides.	Left.	Front	*g*	Common scale of numbers, similar to *a*, the divisions terminating even with the right-hand end.
		Back	*h*	Four scales, values of life annuities, ages 10 to 90, Carlisle probabilities, 3, 4, 5, and 6 per cent.
	Right.	Front	*i*	Similar to *a*, the divisions commencing even with the left-hand end.
		Back	*k*	Marks for setting the slides to various constant divisors.

The grooves will admit either slide, and when both slides are put into the same groove, as will be required in most operations, the two form a continuous scale.

In addition to all the usual calculations to which a slide-rule is applied, the present rule will perform all ordinary calculations, in which compound interest, annuities, or leases for lives or years are involved. In fact, I cannot better describe its application than by saying, that it forms a complete substitute for the tables comprised in Inwood's well-known collection, except the few which relate to 2 and 3 lives.

It will be proper to mention, that the first attempt in this department was made by Mr. Bevan, but the scales which he has introduced are of little use, being limited to 5 per cent. I conceive that four rates are indispensable. I should add 7½ per cent. as a fifth, if room could possibly be found for it.

A rule, corresponding to the brief description here given, the extra scales laid down by myself, is now my constant pocket companion. I should like to know the opinion of some of your readers upon the contrivance. Should it meet with approbation, the next step will be to arrange with some rule-maker to introduce it as an article of sale; the price, I should imagine, would be about 6 shillings.

Yours, &c.

J. W. WOOLGAR.

Lewes, May 7, 1831.

P.S.—There appears to be a slight error in laying down the scale G on Mr. Bevan's rule. It appears to be more correctly applicable to 5·00763, than to 5 per cent.

J. W. W.

REMARKS ON THE PROPORTIONS OF ALCOHOL CONTAINED IN DIFFERENT WINES.

(By a Correspondent at Lisbon).

Sir,—A few days ago I opened, by chance, the 35th No. of the Journal of Science, and I was not a little surprised on reading the analysis of the work published by Doctor Henderson, under the title of "Ancient and Modern Wines," o see at page 135, a note which I have here copied, presuming that many of your readers may not have the facility of referring to the above-mentioned journal.

"In the appendix, Dr. Henderson refers to Mr. Brande's well-known table of the strength of wines, and accuses him of having had adulterated liquors palmed off upon him under genuine names. We were somewhat surprised at this insinuation, as in the original papers in which Mr. Brande established the fact, that alcohol is not formed during the distillation of the wine, he particularly adverts to the pains which were taken to procure genuine and unadulterated samples, and we should presume, that his opportunities of obtaining them were pretty extensive. That the strength of the best wines that can be procured is very fluctuating, his table amply shows. Dr. Henderson, however, condescends to add, that he has abandoned the opinion which he once entertained of fallacy in Mr. Brande's experiments, and largely quotes the table we have alluded to, as standard authority. The fact is, that because certain wines analyzed by Mr. Brande are stronger than those analyzed by Dr. Prout, Dr. Henderson chooses to infer that they must have been mixed with a considerable quantity of adventitious alcohol." Mr. Brande might return the compliment, by inferring that Dr. Henderson's wines were mixed with a "considerable quantity of adventitious water;" but we must leave the chemical gentlemen to determine this point."

Now, Sir, am I to understand by what the critic here says, that Mr. Brande analyzed samples of *pure wine?* That is, wines such as are received from the farmer before any adventitious brandy is added to them by the wine merchants? If so, Mr. Brande has been grossly deceived; and it appears to me, that he never could have laboured under this impression when he formed his table, as printed in the Philosophical Transactions, and his Manual of Chemistry, and which has been copied into so many scientific works.

I can assert, without fear of contradiction from any one that knows what pure wine is, and who has ever resided in a wine country, and made any experiments on the extraction of alcohol from wine, either by the method adopted by Mr. Brande or by distillation, that it is a *physical impossibility* to get much more than *one half* of the quantity of alcohol (specific gravity, 825, thermo. 60°) which he represents to have been obtained.—The *maximum* which can be got, is 13·6 per cent. from the best wine which Portugal or Spain produces. What I mean by "the best wine" is, that which combines every requisite to form a perfect dry wine, and in which all the saccharine matter has been fully decomposed. Now, Sir, my experiments having been made, at least on twenty thousand pipes of both red and white wine, and not from a few bottles, I think I have sufficient data for what I say, and doubly so, when I tell you that my distilling apparatus is of that description, that I can with ease draw off direct from a pure wine, such as comes from the farmer, alcohol of any required strength from the specific gravity of 820 to that of 940, or in other words from 62 to 63 per cent. over proof, to 17 or 18 under proof, the alcohol continually running from the same worm, but the strength rising or falling at pleasure. Nay, this I can continue to do with a 1000 pipes of wine without ever stopping—the low wines of which, after the distillation is finished, will not exceed 10 or 12 gallons, the same as if 10 or 100 pipes had been distilled, and consuming only 60lbs. of dry pine wood for every pipe of wine drawn off at a specific gravity, 878, (say about 30 per cent over proof), this being the strength which is generally made use of here to mix with all descriptions of wines for exportation. At Oporto, the wine company never furnishes the merchants with brandy of a greater strength than 890, S. G., or about 20 per cent. over proof. Now, Sir, in every pipe of port wine shipped to England, there is never less than 16, 18, or 20 gallons (old measure) of brandy of the above strength, which has been fretted into it by the cooper. Let us now see what quantity (a little more or less) of alcohol, S. G. 825, should exist in a pipe of port wine of 140 gallons (old measure) such as sent to London. I have already stated, that the maximum is 13·6 per cent. if the wine is in *a pure state*, but the average of all the wines distilled is much less. However, we will take the best of port wine, to which 18 gallons of brandy, specific gravity 890, has been added, leaving the diminution of bulk out of the calculation.

It will stand thus 140—18=122 gallons, the quantity which we will suppose to be *pure wine*, and to be distilled. From these 122 gallons, it is impossible to get more than 23 gallons of spirit, S. G., 890, by the most perfect still, and from the best of wines. Therefore, a pipe of port wine such as shipped for England, and if analyzed there, would produce rejecting fractions.

99	gallons of residuum.
23	gallons of brandy, distilled from 122 gallons of wine.
18	gallons of adventitious brandy, which had been introduced by the cooper.
140	

Now the 41 gallons of brandy, specific gravity 890, which would be found in the 140 gallons of port wine, as stated above, will give 30·95 gallons of alcohol, S. G., 825 or 22·1 per cent. agreeing very nearly with the average of all the samples of port wine on which Mr. Brande made his experiments. How can it be possible then, that Mr. Brande could ever have been led into the error, that he had made his experiments on *pure wine?* It is evident, he had made use of articles which had been impregnated with very large quantities of brandy by the merchant, after the wines were received into his stores.

These observations are applicable to the Lisbon, Madeira, Sherry, and every other description of wine, whenever the alcohol found in them exceeds that of 13·6 per cent., specific gravity, 825, thermometer 60.

After making the above observations, I cannot help smiling at the errors also committed by Dr. Henderson and Dr. Prout. Notwithstanding what the former says in his Appendix, pages 361 and 362, of his quarto volume, he seems to doubt his own senses, as there can be no doubt that the wines on which Dr. Prout made his experiments, were as much adulterated with alcohol, as those furnished to Mr. Brande; therefore his table, at page 363, is just as useless as the other alluded to. I do not think that Dr. Henderson can have ever visited this country or Spain; if so, he learned very little on the subject of wines. He has many errors to correct if ever he means to publish a second edition,—suffice it to mention two or three.

At page 203, he says, "The lighter sorts of wine, such as Bucellas, are irretrievably ruined by the brandy." Now, I can assure Dr. Henderson and his readers, that he never drank a bottle of Bucellas in England, that had not the proportion of 10 to 13 gallons of adventitious alcohol, 30 per cent. over proof in each pipe.

At page 215, he calls the wine from Colares "*Colares Port*," notwithstanding there is not the least affinity; this wine being always prepared to imitate as much as possible the "*Bordeaux Claret.*"

He then continues to say, in the same page, "The chief white sorts which come to us, are the dry wines of *Termo*, near the mouth of the Douro." It is evident, that Dr. Henderson does not know the meaning of the word "*Termo*;" he takes it to be a place so called. Now the word means a district, such as *Termo de Lisboa*, the *district of Lisbon*—*Termo de Torres Udras*, the *district of Torres Vedras*, &c., &c. Dr. Henderson should know, that there are no vines cultivated within many leagues of the mouth of the Douro, except the wild vine which creeps up the chesnut and oak trees, planted for the purpose; and from which a very inferior and poor wine is made called *vinho verde*, or *green wine*, which is apt to give the colic to those who are not accustomed to drink it. The theory which he advances, at page 332, in regard to shipping port wine in its *pure state* without any brandy, shows how little he understands either the theory or practice of preparing wine; and I would advise him never to attempt the speculation of ordering from this country pure wine to England without brandy. John Bull, in his damp climate, must have something to warm his stomach; and it will be seen, by Mr. Brande's table, that even *Bordeaux claret* has no small share of adventitious alcohol in it.

If you think the above observations are worth a page or two in your amusing and interesting Magazine, you will much oblige me by the insertion of them, as I have been a subscriber to the work from its commencement, and any information I can furnish from hence to your inquisitive readers, will give me much pleasure. Yours, &c.

GINJAL.

Lisbon, April 2, 1831.

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GRAY'S RAILWAY SYSTEM.

Sir,—If the Liverpool and Manchester Railway had been properly constructed, each locomotive engine would have effected as much, or more, than any three of those now employed.

To concentrate the power of the locomotive engine on one specific point, by *separating the propulsive agency from the burden of the engine*, and to reduce the friction of all carriage-wheels as much as possible, by the application of oil to the surface of wheels and rails, are points of the most important consideration in railway conveyance. Were the propulsive wheels of locomotive engines, to work in cog-rails, to be fixed outside of each plain rail, they might be double the diameter of those wheels now used on the Liverpool and Manchester Railway. The facility and economy of this system must eventually attract the attention of all railway proprietors. The multiplicity of engines now required on the Liverpool and Manchester line, and the daily expense attendant thereon, without mentioning the shameful waste of capital necessary for the superabundant number of engines, will also eventually open the eyes of all shareholders.

It certainly will answer the private views of engineers, mechanics, and others employed in manufacturing rails, steam-engines, &c., to recommend the application of numerous engines and the most costly machinery; but, on the other hand, it behoves the public to reflect seriously on the propriety of adopting the least expensive and most efficient plan—that which will require the least outlay for repairs, and be at the same time the most simple and convenient. In every branch of mechanism, the degree of perfection realized will always be in proportion to the simplicity and economy of the means employed.

By the cog-railway system, the whole power of the locomotive engines may be most effectually and economically applied; whereas, on working the engine solely by adhesion, or friction, as on the Liverpool and Manchester Railway, we can only calculate upon a power in proportion to the weight of the engine. Indeed, had the recent grand feat, accomplished by the two *new* ponderous engines, been performed by means of cog-rails, I do not hesitate to assert, that the very same engines would have effected five times more!

As the transport or conveyance of merchandize, cattle, and live-stock of every kind, will, at all times, be found of infinitely more importance in a national point of view, than the conveyance of passengers or correspondence, it cannot be supposed that these considerations will be overlooked whenever my scheme shall arrest public attention. The introduction of cog-rails will in no way interfere with carriages working by adhesion, as both systems may be applied, or not, on the same rails.

By consolidating the present modes of conveyance—turnpike-roads, canals, and coasting vessels—in one improved system of inland steam-conveyance, under the direction of a National Railway Board, to superintend the construction of Grand Trunk Railways, the interests of the nation would be greatly promoted in every point of view—financial, agricultural, commercial, political, and social.

Whatever opposition may yet await my scheme, there is, nevertheless, every prospect of ultimate success It is but the common fate of plans of national improvement, to be at first rejected and contemned, both by government and the public. Witness the introduction of turnpike-roads, mail-coaches, canals, steam navigation, gas, &c., &c. With these instances in recollection of the tardiness with which even the most obvious improvements are adopted, I may be excused for still entertaining a strong hope of seeing my plan accomplished, even to the fullest extent of the advantages which it promises.

The mere *annual* expense now incurred by turnpike-roads and canals, exceeds the whole amount which would be required for the construction of a Genera

Iron Railway throughout Great Britain and Ireland.

The great success attending the general introduction of steam machinery into all our manufacturing districts, as a substitute for manual labour, is certainly a most substantial reason for attempting, by the application of the same economical power to our internal conveyance, to do away with animal power as much as possible. Why should we encourage the breed of horses, at a time when our statesmen are doing every thing in their power to discourage the breed of men? I have been always taught to consider that, the only true source of wealth and happiness to every nation, is a healthy and industrious population; but it would seem that, with our political economists, the fewer men, and the more brutes and machines, the better. I may probably return to this subject; meanwhile,

I am, Sir, yours, &c.

THOMAS GRAY,

Author of Observations on a General Iron Railway.

Nottingham, April 23, 1831.

AIR-PUMP VALVES.

The old form of air-pump valves was found to be very defective by Mr. Smeaton, who greatly improved it by enlarging the surface on which the air acted, which he accomplished by forming the hole with partitions, making each division a perfect hexagon, the whole resembling a portion of a honey-comb, as at fig. 1. It is scarcely necessary to observe, that the partitions were to prevent the membrane being torn, or forced too much inwards by the pressure of the atmosphere. Mr. S. supposed that by increasing the number of holes, the lifting power of the valve is increased in the same proportion, which is not the case, as will be obvious from the following considerations:—Mr. S. formed the valve with seven holes, a centre one and six round it, all perfect hexagons (see fig. 1); because each hole has the same number of sides, and those sides the same lengths, the areas are equal; also because the breadths of these partitions are equal (the whole of them being made as narrow as possible), the adhesion of the membrane by the oil must be precisely alike in each cell, and the lifting powers likewise; therefore, in this view, no advantage is gained by the six outside holes. But when we consider that the adhesion of the membrane touching on the edges of the centre hole is not wholly overcome by it, but partly by the outer ones; for each hole may be supposed to raise the membrane as far as half of the thickness of the centre cell, therefore it rises with half the pressure it otherwise would. If another row of holes was made, it would overcome half the adhesion, and the inner row the other half; for, as shown above, each hole overcomes half the adhesion; consequently, no advantage is derived by making more holes than seven. Neither can we get much advantage by enlarging them, because the membrane or varnished silk must be proportionably stronger, or nearly so, otherwise it would be torn away from the four corner-screws. By following the same principle, *i. e.* allowing a large surface for the air to act upon, and altering the construction, the valve will be greatly improved.

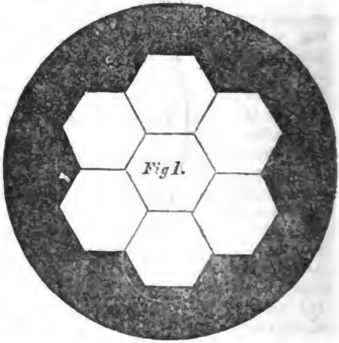
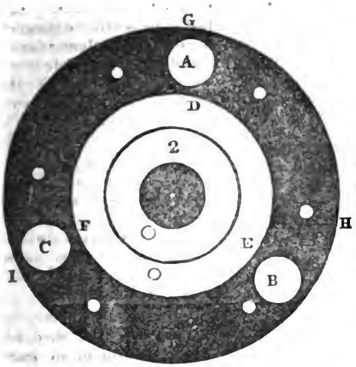
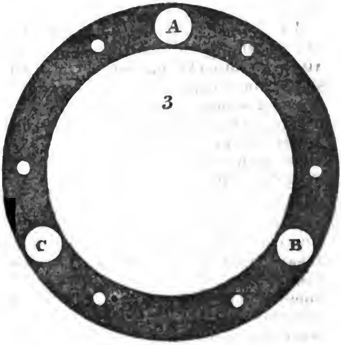


Fig. 2 represents the plate of the air-pump, into which the barrel is screwed. The outer edge GHI is rather less than the inside of the cylinder. The three black circular rims, ABC, DEF, GHI, are somewhat higher than the two white rims, which are two grooves turned below the surface, just sufficient to prevent the membrane touching them when pressed by the air. A communication is formed with the pump and the receiver by a hole in each of the grooves. ABC is a thin, flat rim of brass, (having six screw-holes, answering to the six in fig. 2) which is for fastening down the membrane XY,





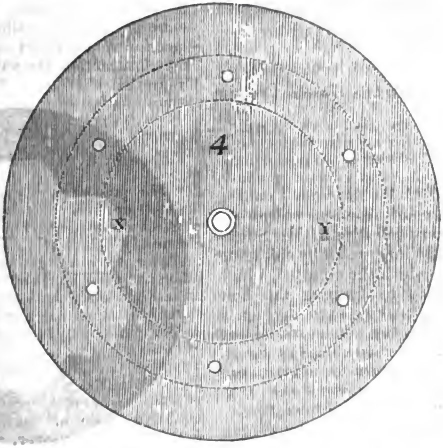


fig. 4, which should be securely fastened to it previously by sowing, the edges being turned over upon the upper side of the rim. The valve or membrane XY, fig. 4, may be made of any thing pliable, which will not admit the air, and is of sufficient strength to bear the pressure. Silk, varnished with elastic gum, answers very well. The small hole in the centre is to allow the air to pass off. This hole must be *considerably smaller* than the centre of fig. 2; indeed, it is not necessary that it should be one-tenth of an inch, whereas the centre of fig. 3 should be four times as much. The two dotted circles drawn on fig. 4, are to show where the brass rim, fig. 3, is fastened. From an inspection of the figures 1 and 2, it will be seen that the superficies of the hexagonal *partitions* is considerably more than the superficies of the circular supporting-ring, DEF of fig. 2; and that the difference is still greater when the centre of fig. 2 is compared with the outer edges of fig. 1; moreover, the air will act all in a body with the former; and does so only partially in the latter, and consequently the membrane will rise with much less pressure.

W. ETHICK.

NATIONAL REPOSITORY—OPENING OF THE FOURTH EXHIBITION.

(Concluded from our last.)

We proceed with our extracts from the official Catalogue.

Machell's Shower Bath.

"Whether required for health or comfort, this apparatus forms an elegant appendage to the dressing-room. The reservoir standing on the floor, it is charged with water without difficulty, and it avoids the liability to accidents which the old form of the shower-bath incurred. The requisite pressure on the water being given by working the air-condenser prior to the use of the bath, the jet remains completely under the control of the bather, who can regulate the force and duration of the shower at pleasure. The whole apparatus packs up into so small a compass, as to be no great incumbrance amongst the luggage of a travelling family."

Murdock's Paddle Wheels.

"Amongst the multitudinous expedients for adjusting the angular position of the floats of paddle-wheels, on immersion and emersion, this is an elegant and ingenious one. But the numerous cultivators of this prolific field of mechanical ingenuity, for the most part overlook the fact, that for a vessel progressing through the water the fittest positions for the entering and quitting floats are at angles oppositely inclined to the surface of the water, and which angles will call for variation with the varying velocity of progression. Under this view it will be manifest that, with a diameter adjusted to the average speed of the vessel, the radial position of the floats upon the wheel will be as nearly as possible that in which the floats, before and after the moment of effective action, will interfere least with the advance of the vessel through the water. Conjoined with this approximation to theoretic truth, the simplicity and solidity of structure of the common paddle-wheel give it incalculable advantages in practice over more complex structures, when we take account of the powerful resistance and rude shocks which the machine must every moment encounter.

"Mr. Murdock has, in the present instance, obtained a pretty mechanical movement by a modification of the original contrivance published by Mr. Robertson Buchanan, in which he availed himself of the fact that the ties connecting the peripheries of two wheels eccentric to each other, during a revolution maintain their parallelism with the line which passes through the two centres. In place of fixing the floats on spindles, the ends of which are the places of attachment for the ties with the eccentric, they are swivelled on points intermediate betwixt the attachments of the ties, *and take their angular direction from guide-pins in the eccentric, playing in forks fixed at right angles on the extremities of the float spindles.* Under this arrangement the floats are only vertical at the two points of the revolution when their centres coincide with the line passing through the centres of the eccentrics."

The observations which the Committee here make on the general subject of paddle-wheel improvements are more just and sensible than any thing we have before seen from the same source. The chief novelty of Mr. Murdock's plan consists in the peculiarity described in that part of the above description which we have given in italics.

Russell's Granulated Grounding.

"The present is stated to be almost a first attempt at a new method of engraving on steel or copper by a grounding mechanically laid. It is intended by the inventor to obviate some imperfections incident to the modes of engraving called mezzotinto and aquatinta. It seems to be capable of more nicety of gradation in the darker parts than belongs to the former of those methods, and being more deeply bitten in than the aquatinta plates are, Mr. Russell's will work off a much greater number of impressions. In finishing, this mode of working permits the assistance of the graver, and a variety of effect can be attained by varying the grounding tool or the mode of using it."

BAKEWELL'S BRICK-MAKING MACHINES.

1. *Machine for Preparing the Earth.*

"Into a process heretofore carried on by machinery of the simplest, sometimes rudest character, Mr. Bakewell has introduced some contrivances distinguished by considerable refinement of mechanical talent. There are several varieties of means for causing the tempering roller to traverse in succession the whole of the bed on which the earth is cast for the purpose of being ground. In the first of these contrivances the radial bar which carries round the tempering roller is lengthened and shortened by an assistant turning it on its axis by means of a short cross lever, whereby the screw on the inner extremity of the bar works through the nut in the head of the centre pin. By another contrivance the assistant effects the elongation or decurtation of the radial bar by means of a pinion and winch in the head of the centre pin, and a rack upon the inner end of the bar. In other modifications of the mill the roller is made to approach to or recede from the centre pin, by sliding itself upon the bar, which is set out of the direction of a radius to the great circle by being centred upon a pin in an arm projecting from the centre post, thus placing the carrying bar in the direction of a tangent to a smaller circle in the centre. As the inner end of the carrying bar is placed on one or the other side of the centre pin of the great circle, the tendency of the tempering roller is to slide inwards or outwards on the bar. The carrying bar is set out of the radial direction in one case by a sector and pinion, and in another by barrels and chains or ropes.

"These mills, no doubt, will grind more uniformly, and temper more completely, the materials employed in brick-making than those in common use about London, where, with greater parade of preparation, they produce unquestionably a more fragile and less durable brick than was made ages ago in the infancy of the arts, and is still made with the least artificial means in the most obscure corners of this kingdom. Mr. Bakewell's mills too, it is stated, will accomplish more work, with the same power, than the ordinary brick mill; and hence their general adoption would lessen the cost, as well as improve the properties, of the bricks prepared by their means."

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2. *Machine for Consolidating the Bricks.*

"The great imperfection of bricks is their porosity, which renders them liable to be broken in throwing about, to be crushed under pressure, and to absorb moisture. This fault arises either from insufficient working of the material, or, as in the London-made bricks, from the intentional admixture with the earth of a foreign matter, which, being combustible, is burnt out in the kiln, and leaves the brick spongy, light, and little able to resist pressure. In stuccoed buildings, all the imperfections of the bricks are screened from the eye so soon as they escape from the hand of the bricklayer; but for many purposes it is essential to have a solid, sound, hard brick, which will not be crushed under a load, and will resist durably the destructive efforts of fire and time. To provide such a brick from duly-prepared materials, Mr. Bakewell has introduced an admirably-contrived press, of unlimited power in its action, of practical facility and rapidity in its use, and so simple and solid in its structure, as neither to be liable to derangement nor demolition in the rude hands for whose employment the machine is destined. By a very skilful combination of levers, Mr. Bakewell has produced a press which at its ultimate point of action is of infinite power; and the result of its operation is the compression of the clay into the greatest compactness and the utmost accuracy of form. The accompanying specimens show that bricks may, by the aid of pressure, applied to a good material duly tempered, be made as solid, and regular in size and form, as have ever been produced either by the Romans or by any other nation of antiquity, whose buildings still exist to attest the superiority with which some of the most important arts of life have been practised in times and places that could not pretend to so much knowledge as is within reach of the artisans of our own age and country."

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3. *Spring Brick Mould.*

"By this mould, which opens on a hinge at one of its angles, and closes by a spring latch, bricks may be moulded of a stiffer clay, and consequently they will shrink less in drying, and be more solid and durable when burnt, than such as have been manufactured from a more diluted material. This mould also promises to expedite the manipulation of that part of the process of brick-making which calls for the use of such an implement."

We consider the praise here bestowed on Mr. Bakewell's inventions to be extremely well merited. Neither is it to be denied, that the art of brick-making is in a deplorably imperfect state in England; but the "Committee of Inspection" seem not to be aware of all the facts of the case, when they represent it to be a matter of unmixed reproach to our brick-manufacturers, that they do not make such good bricks as were produced of old by the Romans and other nations of antiquity, when men "could not pretend to so much knowledge as is within the reach of the artisans of our own age and country." It is by no means from not knowing how as good bricks can be made as ever were made, nor even from the want of machines for the purpose (for there have been several such invented before these of Mr. Bakewell, and perhaps quite as good), that the art remains in so backward a state amongst us. Better bricks were made in days of yore, simply because, in days of yore, Ministers of State did not meddle with the making of them; the Romans had no William Pitt and no Excise. Among the many absurd and destructive fiscal regulations (absurd and destructive even with a view to that revenue which is the object of them) for which the English people are indebted to their "heaven-born" Statesman, was one by which a duty of 5*s*. 10*d*. per thousand was imposed on "*common*" bricks, and of 12*s*. 10*d*. on "*polished*" ones, that is, *the better the brick, the heavier the tax*. Can it be wondered that the spirit of improvement should have taken its flight from an art so shackled and oppressed?

Pope and Co.'s Hosiery.

"In this instance manufacturing refinement seems to be carried to its utmost limit; the material has almost become, in the language of mathematicians, an evanescent quantity. The stocking weighs 45 grains, and though it may ornament, can scarcely be said to protect or conceal. The production is a curiosity in mechanical art."

Brooking's Rudder.

"Turning on pins carried one-third into the breadth of the rudder, there will be less pressure on the tiller, when the rudder is made to act; and the space left between the rudder and stern-post, it is calculated upon by the inventor, by allowing a passage to the current on the lee side, will lessen a retarding pressure on that side of the rudder."

Brooking's Diagonal Seaming.

"By this method, Admiral Brooking states that greater strength in the direction of the stress upon the sail is obtained; the sail is not so liable to bag, and consequently with an angular wind, the propulsive action will be greater, and the ship will not be so much laid down."

Rugs of Irish Manufacture.

"The manufacture of this article of luxury and comfort has been established by a lady on the estate of the Rev. John Cromer Roberts, at Gormanston, in the county of Kildare, Ireland, with the laudable view of giving employment to the females and children of the poor in her neighbourhood. The rugs when soiled can be restored to their original whiteness by washing, and are sold at a reasonable rate, the price in Dublin being 2s. 3d. per square foot, in London 2s. 6d."

The "Committee of Inspection" might with perfect propriety have added to the articles thus particularly pointed out to attention, the Fire-Escape of Colonel Walker, and the Grenade Rifle-Ball of Captain Norton. The public, it is true, have been already made acquainted with their merits through different publications (see, among others, the Mechanics' Magazine, Nos. 399 and 400): but we do not see why this should have made the Committee less disposed to bear testimony to the great ingenuity displayed in them.

Even with the addition of these two inventions, however, the total number of articles which appear, in the estimation of the Directors of the Establishment themselves, to be good for much, is only thirteen! None of the three former Exhibitions—though they were all wretched enough—were half so bad as this. The falling-off is so great, that it can presage nothing else than extinction. The decay is, too surely, a galloping one, and close at hand must be the hour of giving up the ghost.

It is but fair to the Managers of the Establishment to mention, that there is, stitched up with the Catalogue, a slip of paper, containing the following apologetical notice:—

"Owing to *the delay in sending in specimens intended for this year's Exhibition*, the Committee of Inspection has not been able to complete the arrangements in the Gallery, or to make further progress in the Catalogue than the limited matter now presented in a small impression for immediate purposes."

The idea evidently meant to be conveyed to the public by this notice is, that the Catalogue exhibits only a small portion of the articles sent in for exhibition, and that a great many more remain behind, to be added in a future edition. But why, if this were true, not say so in plain terms? Would not the Committee have done so if they could? They are pleased to say there has been a "delay in sending in specimens *intended* for this year's Exhibition;" but all they can know as matter of fact is, that at the time when it was necessary to begin the preparation of their Catalogue, the number of articles sent in was so small as to be scarcely worth the trouble of enumerating. Several things we did observe in the Gallery which are not included in the Catalogue, but not more than one or two of the least importance. Were the Committee even to double or triple the number of articles in their Catalogue, (of which they can hardly have any hope) they would still be a prodigious way from making good the claim of the Establishment to the "national" character it has so humbuggingly assumed. And before they could double or triple the number of articles, they would require to have a new Gallery to hold them—for such is the opinion which the Government entertain of the *growing* and *thriving* condition of the Institution, that they have this year deprived it of one half of the garret room which it originally occupied; and the small space left to it is no more than sufficient to exhibit conveniently such a small lot as that of which we have been endeavouring to give our readers some account. The gentlemen of the Treasury appear to have calculated the demands of the concern to a nicety.

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WOOD ON RAILWAYS. [*]

The reader will recollect the mention made in our account of the Locomotive Competition at Liverpool in October, 1829 (Mechanic's Magazine, vol. xii., p. 129) of a memorable judgement pronounced by a certain writer on railways, to the effect, that to expect to "see engines travelling at the rate of twelve, sixteen, eighteen, or twenty miles an hour," was "ridiculous nonsense." We then congratulated this incredulous gentleman on being spared to see his "ridiculous nonsense" reduced to an unquestionable matter of fact; and we have now still farther to congratulate him, on his living to produce a new edition of his work, in which we meet almost at the opening with the following honest recantation.

> "The experiments previous to, and the subsequent practice, of that railway, since the opening, have exhibited a result as astonishing (to the author) as it is important. Not only has the question been decided, and in the most conclusive and practical manner, that railways are fitted for the conveyance of general merchandize, but, with the assistance of locomotive-engines, it has been proved that they are capable of effecting a rapidity of transit, greater than by any other practical mode of travelling. The greatest exertions have been used to accelerate the speed of the mails (which have been hitherto the quickest species of conveyance), without being able to exceed 10 miles an hour; and that only with the exercise of such destruction of animal power as no one can contemplate with feelings except of the most painful nature, while upon the Liverpool Railway *an average rate of fifteen miles is kept up with the greatest ease; and, on an extraordinary occasion, nearly double that rate, or thirty miles in one hour.*"—Introd. p. xi.

This new *edition* of Mr. Wood's Treatise is, in fact, almost an entirely new work: and though it proves him to have been no prophet, displays upon the whole a love of truth, and an industry in the search after it, which are of a very redeeming character. The author states, that "the whole has been revised, and such parts only retained as appeared to be useful in illustrating the progress towards improvement." "Numerous experiments, too, have been made with a view of supplying, not only what was wanting in the first edition, but also of elucidating the various improvements, which successive experiments elicited." And the author acknowledges "his obligations to several friends, from whom he has obtained very valuable information," not contained in the first edition.

The parts of this edition which possess most novelty, and to which we have naturally turned with most interest, are those in which Mr. Wood treats of the form and construction of the carriages used upon rail-roads, and of the various sorts of engines which have been constructed for propelling them.

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[*] A Practical Treatise on Rail-roads and Interior Communication in general, containing an Account of the Performances of the different Locomotive Engines, at and subsequent to the Liverpool contest, upwards of two hundred and sixty Experiments, with Tables of the Comparative Value of Canals and Rail-roads, and the power of the present Locomotive Engines. By Nicholas Wood, Colliery Viewer, Second Edition, 530 pp. 8vo., with numerous engravings.

The *waggons* employed for the conveyance of coal, lime, &c. at the first introduction of railways, and still in general use in the northern coal fields, were of the shape of a hopper, broader and longer at the top than at the bottom; and, as the rail-roads had almost universally a downward inclination to some place of deposit or loading, the fore-wheels were made of a greater diameter than the hind wheels—that, by this means the waggon might be kept in a horizontal position. The fore end of the waggon resting on the large wheels, was also made to project a good deal farther beyond the perpendicular line of the axles of the fore than that of the hind wheels, so that the centre of gravity of the load was not midway between the wheels, but much nearer the large wheels than the smaller; throwing thus the greater portion of the weight upon the larger wheels.

Mr. Wood informs us, that "this form of waggon has gradually given way to wheels of the same size, and the body of the carriage square, and placed equally upon the two axles." (p. 64.) He enters into no explanation of the reasons for this change, and perhaps it was not necessary—the benefit of equalizing the strain and pressure, being abundantly manifest; but we are rather surprised it did not occur to Mr. Wood, to be a circumstance worth pointing out to the attention of his readers, that the form which was thus exploded for its disadvantageous clumsiness, in the case of the common waggon, should, in its principal features, be the very form afterwards adopted by Messrs. Stephenson and Co. in all the steam-carriages constructed by them for the conveyance of passengers at a quick rate, previous to the publication of this book of Mr. Wood's. We should have been well pleased to see some satisfactory cause assigned by Mr. Wood, why a mode of construction, which has been found attended with a loss of power, in one class of carriages, should be the best of all modes when applied to another! Mr. Wood does, in a subsequent part of his work (page 313-16) attempt to explain, at some length, why steam-carriages with the fore wheels double the size of the hind ones, and with the greater portion of the weight thrown on the former, ought to work better than any others; but supposing this explanation were satisfactory, consistency would seem to require of Mr. Wood, that he should recommend the makers of waggons, to revert to their original mode of construction, which, as we have seen, is precisely that which Mr. Wood here advocates. The truth, however, is, that the explanation to which we allude is, the very reverse of being satisfactory; the makers of waggons did well in abandoning their old mode of construction, and Messrs. Stephenson did very unwisely in imitating it. This it would be easy to demonstrate; but we are spared the trouble of doing so, by the course which events have taken since Mr. Wood wrote; for, strange to say, just as Mr. Wood sends forth to the world this elaborate justification of the mode of construction followed by Messrs. Stephenson and Co., these gentlemen themselves furnish the best possible refutation of the absurdity of their friend's arguments, by putting on the railway two engines (the *Samson* and *Goliah*) with the wheels all of one size, and all equally tasked, which are said to work fifty per cent. better on this account, than any engines that have preceded them, and are beyond all question vastly superior! (See Mech. Mag. vol. xv. p. 35).

The wheels of all railway-carriages were for a long time made entirely of wood, with wrought-iron axles. Afterwards cast-iron wheels were introduced, and their general adoption greatly facilitated by the invention of a mode of hardening their rims—called "case hardening"—which is thus described by Mr. Wood.

> "This is done by running the metal which forms the exterior surface of the rim of the wheel against a cold cylindrical piece of iron; the rapid attraction of heat by the cold iron produces such a degree of hardness to the metal, that the file has no effect upon it, and this hardness effectually prevents the action of the rail from wearing it into grooves. Previous to this, the cost of wheels was a very serious charge in the annual repair of carriages, but the wheels now, when properly case-hardened, work for many years without wearing away. Several

which have been in use for eight years are still in good order; and, from their appearance, are likely to remain so for a considerable time to come. The operation of case-hardening was at first attended with great difficulty. The rapidity with which the cold iron caused the rim to cool prevented the uniform contraction of the metal in all the parts, and made them frequently fly in pieces. The rim being first cooled, did not yield to the contraction of the spokes in cooling; which, if it did not cause them to separate immediately, left such a tension upon them, that the shocks they received when brought into use soon made them crack, and thus rendered the wheel useless. Many plans were devised to remedy this; in some the rim was made considerably thicker than the spokes, in the expectation that the latter would cool sooner; in others, the nave was formed in two parts, and afterwards secured with iron hoops. In a patent of Messrs. Losh and Stephenson, there is described a mode of forming the wheels with wrought-iron spokes in such a way as to yield to the unequal contraction occasioned by the case-hardening of the (rims of the) wheels. The arms are of flat malleable iron, dovetailed at the ends. The iron arms being laid in the mould, the cast-iron is run around them, and thus forms one entire wheel. When the arms or spokes are joined to the nave and rim, the dovetailed form, by the contraction in the cooling, causes them to be drawn very firm, and produces a degree of combination which prevents the possibility of their working loose. The spokes were first made straight, and were six in number; but experience has since shown, that a greater number are preferable; and they are also now made of a serpentine form, so as to yield to the contraction of the rim in cooling."—Pp. 68-70.

That cast-iron wheels—even when case-hardened in the best manner—are very liable to break, at such velocities as are now common on railways, is however freely admitted; and, in point of fact, it has been found necessary either to secure them by wrought-iron hooping, or to return partially to the use of wood.

"The cast-iron wheels of the Killingworth engines had been hooped with wrought-iron tires, which was not only found to be quite practicable, but also a great saving in the wear; since that time the wheels of the engines made by Messrs. Stephenson and Co. have been either made of cast-iron, hooped with wrought, or with wooden spokes, on which was laid a malleable iron tire. Wheels thus hooped, though more expensive, seem quite necessary for the rapid rate at which some of those engines are propelled. The same plan of hooping the cast-iron wheels with wrought-iron tires has been also adopted with respect to the common carriages, which, like the engine-wheels, though more expensive, is strictly necessary."—P. 71-72.

On the resistance to the motion of railway-carriages, arising from the friction on the axle and the rails, and the most expedient means of reducing it, Mr. Wood has favoured us with a long chapter (vi.) The reader is aware that a great diversity of opinion on this subject prevails in the scientific world; and no wonder, since scarcely any two sets of experiments which have been made with a view to its determination have yielded similar results. Mr. Wood gives us the details of a great many new experiments which he has made since the publication of the first edition of his work, in the hope of throwing some light on the matter; but he frankly acknowledges, that though "sufficient in many cases for practical purposes, yet they by no means tend to bring the inquiry into any more settled state;" but establish, on the contrary, that "at present *no settled standard* can be assigned to the actual amount of friction."

In the first edition of his work, Mr. Wood estimated the friction to be equal to $\frac{1}{200}$ part of the insistent weight; but he now thinks "the resistance may be taken at the 240th part of the weight when the carriages are in good working order." It would seem, however, that something besides "good working order" is necessary to produce this more favourable result; for Mr. W. elsewhere lays it down as an established principle, that to make "the friction in strict ratio to the weight" "the area of bearing surface" must be duly apportioned to that weight. His experiments show, that the friction is a minimum when the pressure per square inch of bearing surface is about 98lbs.; but when this ratio is either exceeded or diminished, great allowances are required to be made.

As large wheels surmount obstacles more easily than wheels of small diameter, it would seem a natural inference that the diameter of the wheels should be made as large and the axles as small as possible; but Mr. Wood shows, that in practice there "is a limit to this."—"The axles must be made sufficiently large to support the weight placed upon them, and that strength must be increased with the size of the wheels, for the larger the wheels the greater the leverage to twist and break the axles." However, "as the tendency to break the axles, increases only in the direct proportion of the diameter of the wheels, while the strength of the axles increases as the cube of their diameter," Mr. Wood recommends, that in all cases the wheels should be of "as large a diameter as circumstances will permit."

Mr. Stephenson constructed a carriage with wheels three feet in diameter, and with the axles only $1\frac{1}{8}$ in diameter; but on trial nothing was found to be gained by this extreme diminution in the size of the axle.

With Mr. Winan's plan of diminishing the resistance by means of friction rollers, our readers are already acquainted (see Mech. Mag. vol. xii, p. 210). A similar plan was also submitted to the Directors of the Liverpool and Manchester Railway, by Mr. Brandreth. But it appears, from a series of experiments related by Mr. Wood, that neither of them have realized that "reduction of friction" which their inventors anticipated.

(To be continued in our next.)

SMOKE-JACKS—ANSWER TO INQUIRY, P. 127. VOL. XV.

Sir, I am rather at a loss to know whether your constant reader, p. 127, means an alteration in the fly of the common smoke-jack, as usually fixed in a vertical chimney, or whether he wants one to fix in a horizontal flue. If the former, I do not see any good reason for altering that which has worked well for ages. If the latter, I beg to say there would be no difficulty in making one, but I much doubt its usefulness when made. In the first place, the smoke, &c. loses much of its velocity by friction against the top and sides of the flue, and more from parting with its caloric, which it does much more freely in passing through a horizontal than a vertical flue; witness, placing the hand on one, and against the other. Secondly,—the current of smoke, &c., diminished both in bulk and velocity, would be confined principally to the upper part of the flue, consequently a portion only of the fly could be acted upon at once. Thirdly—it would be much more likely to be impeded than the common jack, by the accumulation of soot, dust, &c. Your correspondent is, no doubt, fully aware that the whole power or motive force of a smoke-jack is derived from the heated air impinging on the vanes of the fly, in its passage up the chimney, therefore the freer the chimney is from bends, sets-off, or any obstruction, which by causing eddies, or in any way injuring the draught or current, the greater will be the power of the jack.

Yours, &c. TREBOR VALENTINE.

Derby, May 4, 1831.

ROOFING—ANSWER TO INQUIRY, P. 447 VOL. XIV.

Sir,—J. B. is informed, 1st. That if his roof rise no more than 2 feet in 12 or 13 feet, it is decidedly too little for any of the ordinary modes of covering in a building.

2nd. It is not easy to answer how much the rise ought to have been without knowing of what materials the covering is composed.

3rd. A total want of information on that head must also be my excuse for not stating what would be cheaper.

Yours, &c. J. CANSDELL.

Steam-Carriages on Common Roads.—Some of the advantages to the public from the use of steam on turnpike roads begin to show themselves. Previous to the starting of the steam-coach between Gloucester and Cheltenham the fares were 4*s*. each person. Now the public are taken by all the coaches at 1*s*. per head. On Monday morning the steam-coach took 33 passengers from Cheltenham to Gloucester in 50 minutes.—*Times, 12th May.*

INTERIM NOTICES.

Communications received from the Ed. Vocis Rationis—Mr. Bertin—Mr. Pearce—Mr. Dudley—Sago—An Exhibitor—Mr. Bentley—Nil Admirari.

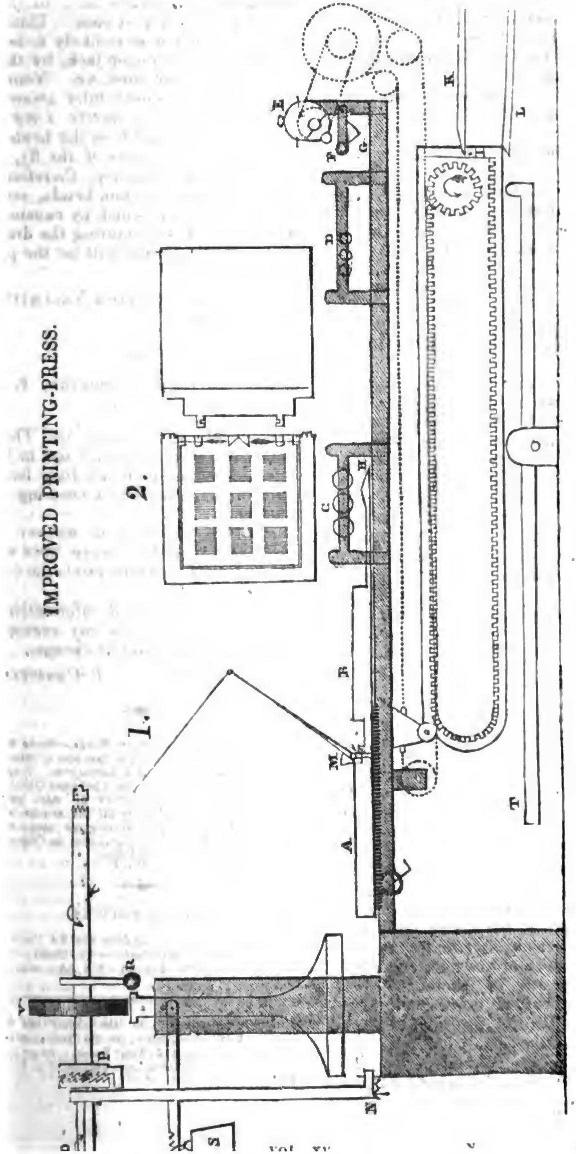
LONDON: Published for the Editor and Proprietor, by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 406.] SATURDAY, MAY 21, 1831. [Price 3*d*.

IMPROVED PRINTING-PRESS.



IMPROVED PRINTING-PRESS, INVENTED BY JOHN CLERK MAXWELL, ESQ., OF MIDDLEBIE.

At a meeting of the Society of Arts for Scotland, on the 5th of January last, the following paper of "Suggestions" for the improvement of the Printing-Press by Mr. William Fraser, printer, Edinburgh, was read by the Secretary:—

" 1. *Suggestions by Mr. Fraser.*

" It is well known that of late years a vast additional power has been given to the art of letter-press printing, by means of machinery. For speed, the newly-invented printing-machines, when compared with the manual presses, are to printing what the power-loom is to weaving; and, accordingly, they are of great utility in all establishments where newspapers and other periodical works having a large circulation are printed, and of course where the greatest number of impressions is required in the shortest possible time. But although the machines have been very much simplified since their first introduction, and much neater work is now accomplished with them than at first, yet they are still so expensive, and the manual presses so superior to them for the purposes of fine printing and general economy in the case of small impressions, that it is doubtful if the present kind of machines will ever come into general use. In confirmation of this opinion, it may just be stated, that long as these machines have been used in London, only two offices in Edinburgh have as yet obtained them, and we are not aware of there being a single machine elsewhere in Scotland. The machines, however, possess in their inking apparatus one decided advantage over the common presses, for by it the ink is applied to the types with the utmost regularity and equality; while, at the common press, it is laid on in greater or less quantity, and with more or less regurity, according to the care or judgment of the pressman. Hence it frequently happens, in the latter case, that no two sheets, nor even both sides of the same sheet, are perfectly uniform in colour, though printed at the same press, and, at all events, seldom or never if printed at different presses.—In printing each sheet at the old press, two men are employed, the one for applying the ink, and the other for laying on the paper; and within the last 25 years a subsequent process of pressing or smoothing the printed sheets has been introduced, likewise requiring the labour of other two individuals. This last operation is performed by placing a printed sheet and a thin glazed pasteboard alternately above each other, till a sufficient number be obtained for filling a large screw-press or hydraulic-press. This being done, a very powerful pressure is applied, and the whole then allowed to stand consolidated for some hours, by which means the printed surface is completely flattened, and a glaze at the same time imparted to the paper. A book is much improved in appearance, but it is at a great additional expense to the printer, and for which he receives little or no extra remuneration. It would therefore be of no slight advantage to him could the manual labour of printing and pressing be diminished, and the inequality of inking at the press remedied; and it is conceived that both of these objects may be accomplished by the following or some similar means, to which the attention of engineers or of others acquainted with the subject is requested. 1st. As to the inking-apparatus, that attached to the machines of Messrs. Cowper and Applegath might be placed immediately behind the tympans of the Stanhope or Columbian presses, and be worked by steam power as at present. Were the tympans and carriage of the press in separate pieces, but made so as to fit very exactly into each other, the carriage might, after each impression, be taken from the hand, upon reaching a certain point, by the inking-apparatus, and, upon the types being rolled, returned to the same point. In the interim the pressman could be laying on and off his sheet, and by the time he had done so, the former would be again stationed at his hand, and ready for his taking another impression. It is obvious that the great difficulty to be overcome here will be the construction of the machinery for receiving and returning the carriage, and making the carriage so nicely to fit the frame-work of the tympans as to preserve *register*, as it is called; but, after the ingenious contrivance of Mr. Napier in his machine for receiving and giving off the paper, there can be little doubt of these difficulties being soon obviated. In this way the great desideratum of securing an equality of colour would be supplied; and the expense of an apparatus for each press, with an engine-power for the whole, would be compensated, by only one-half of the men being required. 2d. We have lately seen a cylindrical machine by Mr. A. Moir, of Glasgow, used for pressing and glazing white paper; and, although this machine, in its present state, is not altogether suited for the pressing of printed sheets of books, yet it may also be easily adapted to this purpose. The labour of turning it, however, is perhaps such as to prevent its adoption, unless where steam power is at hand; but, were every printing-office supplied with this power, the cylindrical pressing-machine would probably soon supersede the expensive and tedious operation of the glazed boards and hydraulic-press.—It will thus be perceived that the object sought to be attained is a still further combination of manual labour and mechanical power: and could the above, or similar suggestions, be carried into effect, another great step would undoubtedly be gained in the art of printing."

A Committee was appointed to consider and report on Mr. Fraser's "Suggestions;" and at a subsequent meeting of the Society on the 2d of March, John Clerk Maxwell, Esq. a Member of the Committee, communicated the following "Outline" of a plan which had occurred to him as "fitted in some degree to accomplish" the desiderata pointed out by Mr. Fraser:—

"*Mr. Clerk Maxwell's 'Outline.'*

"In the accompanying sketch,* which is intended merely to give a general notion of the plan without details, no part of the necessary frame-work is represented, except the cheeks of the press, and the range of the frame-work of the inking-apparatus, which are slightly shaded. The inking-apparatus is arranged on the plan of Messrs. Cowper and Applegath, with an inking-table, which is understood to produce the best work.

"The drawing represents the press in a state of rest. A the coffin and form with tympan open, B the inking-table, C the inking-rollers, D the distributing-rollers, E the ink-trough, with its rollers, to be put in motion by the pulleys and bands (both dotted in the sketch); but the proper rates of motion are not attempted to be shown—only the mode of communication, and where an alternate motion is improper, the pulleys would be furnished with a ratchet and spring, so that they would revolve in one way only. F is the supplying-roller, which is raised to touch the ink-trough rollers, on the advance of the ink-table by the wedge H, on the carriage of the ink-table acting on G. Under these parts is an oblong rack-work, connected by a hinge with the under side of the ink-table; at the right-hand end of this there is a wheel, supposed to be in constant motion, connected with the moving power. On the end of the rack is a projecting pin I, intended to slide along the bar K, and fall over the end of it, when the lower corner of the rack would rest on the bar L, on its return. (The length of the bars K and L is equal to the extent of the motion of the rack, but, in the engraving, parts only of them are represented. for want of room.)

"The tympan has a carriage of its own, separate from the coffin and form, (which might be called an outer coffin), which is made with three sides, the true coffin and form in it being intended to slide out, in order to be carried to be inked. This is shown at fig. 2, where the shaded part marks the outer coffin, with marks for the hinges of the tympan, and within it the true coffin and form; beside these, is drawn the ink-table; this has two pegs with notches, which go into corresponding holes in the coffin, attaching and locking them together in the same way as the fastening of the bit in a carpenter's brace. On the tympan, as shown in fig. 1, there is a quadrant of a spiral curve M; this is an important part. When the tympan is open, the coffin is free to be drawn out, and it is locked to the inking-table; but in shutting down the tympan, this part, by the spiral curved edge, wedges the coffin and form hard home in the tympan carriage, so as to secure its true position to preserve *register*, and at the same time the sides of the quadrants press back studs which, unlock the coffin from the inking-table.

"The press may be of any approved shape or material, and it has its spindle acted on by an eccentric wheel V, which is to be put in motion when the coffin is run home in the press, by its pressing on the end of the lever N, which throws the press into action, the shaft or axle O being in motion from the moving power, and properly sus'ained by a fly-wheel. The press then descends, and, on its return, the wiper P throws this part out of gear, and at the same time presses back N, which, striking on the coffin, gives the signal for the pressman to run it out. The platten is counterpoised by S, and the eccentric-wheel by R, so that when free the parts settle in the position ready for action, the wiper P being behind the lever N; on the lower end of N is marked two notches, with a round part between them, with a catch pressed upwards by a spring; this is to make the lever N settle in the positions of being quite out of gear or perfectly in gear.

"The working of this apparatus by one man would be thus arranged; he would commence with the tympan down, and by acting on the treadle T he raises the rack, so that the pin I may slide along the bar

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* Given in the front-page of the present Number of the Mechanics' Magazine.—Ed. M. M.

K; the wheel then carries the inking-table alone under the inking-rollers and others, and returns it to its position; this is to be repeated till it is fully charged with ink, then he opens the tympan and touches the treadle, and the form is carried off to be inked, while he places white paper on the tympan; the form being returned to its place and the tympan shut down, he runs it home into the press, the inking-table being left at rest. The pressman would bear on the winch till the press falls, and then reverse his action, ready to run the form out whenever the lever N strikes it back. Having run it back and opened the tympan, he touches the treadle, and proceeds to change the sheet while the inking process goes on, and repeats these operations while he continues to work.

"I have thus described the contrivance in its most simple arrangement. The ordinary plans of framing, and the various modes of relieving friction, and all accessories met with in modern machines, are supposed to be used where wanted.

"One of the objections most probable to arise at first sight is the inconvenient length of the machine, but this may be obviated in many ways. 1st. If shortness be an object of importance, it can best be obtained by applying those contrivances for inking which do not require the inking table; for if the distribution of the ink be done entirely by rollers, for example such as those used in Napier's machine, then these could be placed under the gallows of the tympan, and the form would have to be moved little more than its own breadth. 2d. Supposing the inking table retained, as the method best suited for fine printing, the long rack-work may be superseded by a short one, and the necessary extent of movement effected by the use of wheels and pinions, or by pulleys and bands,—the diameters of the pulleys being so proportioned as to increase the motion; and here it may be observed, that it may probably be found advisable in all cases to interpose pulley and band between the toothed work and the inking table, to free it as much as possible from tremor. 3d. Instead of the long rack-work, circular work may be used, either by using alternately the outside and the inside of a toothed circumference, as is done in the Patent Mangle, or by using two wheels, moving in opposite directions, having teeth on one half of their circumference, acting on two lines of rack-work; and if multiplying pulley and band work were interposed between these wheels and racks and the inking-table, they might be reduced to a very moderate size.

"With regard to the contrivance for working the press, I may observe, that the excentric wheel has the advantage of a motion slow and powerful in proportion, at the first, in order to overcome the *vis inertiæ* of the apparatus of the press, and also at the point of greatest pressure; while it is quicker in the middle parts of the action, both in the rising and the falling of the press; and the resistance of the wiper in throwing the work out of gear, would serve to exhaust the momentum of the eccentric wheel, its axles, &c. &c.

"In the Sketch, the shaft for putting the press in motion is supposed to pass right over the press, and the eccentric wheel to act directly on the spindle of the press; but it is evident the effect may be obtained by the intervention of a lever at whatever distance the shaft may be; and so the contrivance may be suited to any situation, and, instead of acting on the spindle, it might be arranged to move the bar of a common press.

"When a few impressions or proofs merely are wanted, the inking apparatus need not be used, the hand-roller, used in the common way, serving instead; and as the inking apparatus and that for working the press have no connection, one or other, or both, may be used at pleasure; and if the press were fitted with a bar, in addition to the eccentric wheel apparatus, the press might be used in the common way, when the engine moving-power was not in use.

"It may be proper to state the supposed rate of execution of the press I have described. The shaft for the eccentric wheel is supposed to revolve once in two seconds, and the wheel of the rack-work once in each second, and that eight revolutions complete the operation of inking. The time necessary to run the coffin into the press two seconds, and the same time to run it out.—Then,

"The time of inking, during which also the sheet is taken out, and a white one placed in the tympan, is	8"
Running in . . .	2"
Pulling . . .	2"
Running out . .	2"
	14"

One impression in 14 seconds gives 256 in the hour.

"In the Sketch, the outer coffin, or carriage of the tympan, is supposed to consist of three sides, and without a bottom, and made very thick in the sides for strength. Perhaps it would be better to be made with a bottom, in which case, the winter and range, so far as the tympan carriage has to be moved, must be as much lower than the range for the inking table as the bottom is thick, that the form may be on the same level as the inking table."

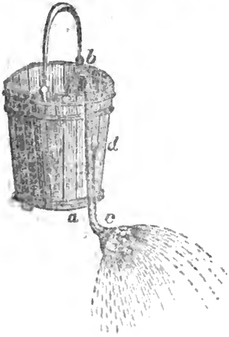
In the Edinburgh New Philosophical Journal, to which we are indebted for the preceding documents, there is also a supplementary "Note by Mr. Fraser," which we subjoin in an abridged form.

" *Note by Mr. Fraser.*

"Since the paper referred to by Mr. Clerk Maxwell appeared, we have been favoured with communications from Mr. Cowper and Mr. Napier, the patentees of the two printing machines formerly alluded to. The latter states, that he has already secured a patent for machinery, part of which, although differing from that proposed by us, is intended for the same purpose; and Mr. Cowper says, that his patent for the large machines includes also the application of the inking-apparatus to the common press. We have also conversed with Mr. Cowper, junior, who mentioned that, when lately at Paris, he saw the self-inking apparatus actually attached to the common press, and at work, in the Royal Printing-office there; but that the inking-apparatus was ultimately abandoned, in consequence of the unforeseen obstacle in pulling, which it is one particular object of Mr. Clerk Maxwell's invention to remove.

"It is curious that, on the other side of the Atlantic, the application of a self-inking apparatus to the common printing press has at the same era been thought of, and carried into effect. In the number of the Christian Instructor for February last, it is stated, that an American journal, speaking of the improvement in printing, remarks, that "the introduction of the Napier machine into this country, together with the Treadwell press, made at Boston, has been the means of producing quite a revolution in printing. A great variety of machine presses have subsequently been invented here, *and the self-inking apparatus has been improved and applied to the common press.'*—'The most rapid machines can be made to strike off 5000 impressions in an hour. This is equal to the work of 20 hand-presses; or, to express it differently, it will enable us to print the common 18mo. Bibles at the rate of 75 copies an hour. A hundred presses at this rate, could supply every family on the earth with a Bible in three years.'—For the printing of publications having a large circulation, machines possess a decided superiority over the common presses; but by far the greatest proportion of the printing business everywhere consists of works of which comparatively few copies are required. On this account few printers could keep a single machine in constant employment, even were it otherwise applicable to such work, which it is universally admitted not to be. Besides, six good presses can be obtained for the price of one machine, and these, too, can be applied to a variety of purposes at the same time, and one or more only be used as circumstances may require. Should a press be at any time unemployed, there is comparatively little loss, for the first cost is not great, and there are no men's wages to pay in the interim; but the very reverse is the case with a printing machine, the original outlay for one, independently of that for the engine, &c., being from 400*l*. to 700*l*., and a considerable subsequent expense of keeping in repair, and a stated rate of wages to one man and two boys at least. Hence it is evident that common presses must continue to be in more general use than printing machines; and could Mr. Clerk Maxwell's ingenious improvement be carried into effect, there is no doubt of their value and utility being greatly increased. By it, not only would the labour of one man at each press be entirely saved, but that of the other be also reduced to little more than supplying the sheets of paper. The quality of the work, too, from the regularity of inking and pressure, would be much improved, and means would undoubtedly soon be fallen upon for increasing or diminishing the quantity, in a given time, according to the nature of the work in hand. There would certainly be the additional expense attendant upon an engine, &c. for each printing office, which there is not at present: but surely if the same kind of mechanical power be found more economical and advantageous than manual labour for coffee-grinding, and similar purposes, it would be much more so if it could be rendered applicable to the important operations of miscellaneous letter-press printing. In short, it is very evident that the demand for printing presses and self-inking apparatuses of the kind contemplated would be every where very great, and would soon amply remunerate any one, whether in Europe or in America, who might be so fortunate as to bring them first into effective and economical operation."

A WATERING SYPHON.



Sir,—I have often thought it would be a very useful application of the syphon, to employ it for the several purposes for which watering cans are required. The alteration is a very simple one, and as it does not require that the vessel to be used, be made exclusively for the purpose of watering, the contrivance might be of some benefit to gardeners, when they have much ground to water, likewise to shopkeepers, in laying the dust on the foot-walk or the street fronting their premises, for all which a bucket or even a jug may be used with the syphon.

In the figure, the syphon *a*, *b*, *c*, made of lead or tin pipe, has a rose, *c*, fitted to the longer leg; at *d*, is a lesser pipe for drawing off the air. It is obvious, that by this means the operation will be performed with many advantages over watering-cans, especially when of large capacity, as the syphon will draw off the water without changing the position of the vessel. To water a grass-plat or other extended surface, it would be a convenient method to use two pails slung to a pole laid across the shoulders.

Yours, &c. HENRY D.

Liverpool, April, 1831.

MANAGEMENT OF BEES.

Sir,—Having for some years past been devotedly attached to the management of bees, and observing in the number of your work for February 11, 1830, a new mode of placing hives suggested by a gentleman, whose remarks convince me that he is by no means a novice in the art—I beg, with your permission, and through the medium of your widely-circulated pages, to request a little further explanation of the plan, intended to be represented by the first drawing in the above number.

I am perfectly acquainted with Mr. Nutt's mode of management, containing the ventilating apparatus, &c., and have repeatedly seen some of those hives at work, and been much pleased with them, as being generally very numerous and powerful colonies; but was not aware, till seeing Mr. Massingbird's remarks, that Mr. Nutt adopted or recommended any other system than the collateral one. The hives referred to above, however, are clearly according to the Russian or Story method; but from the experience I have had in the art, I am induced to conclude, that the bees will produce as much honey and wax in one shaped hive as an other. if, by room being given, they are prevented from swarming, and that, if this be done, it matters not whether the hives are placed above, below, or on a level with each other.

But to return, Sir, to the Cottage Bee-hive represented by the plate No. 1, A. I suppose that the bottom of the frame at DD, is a *solid* piece of wood, 2 feet square, for the box floor.

A common Cottage Hive, appears to be inverted and placed under this floor, and fastened by ropes to the staples DD.

Is it the intention that any bees should be in the common straw hive; and if so, are they intended to work out of it into the box above, through a hole cut in the middle of the box-floor, or (as I should conceive to be the intention) is the common hive placed there *empty for the convenience of weighing only?*

I do not clearly perceive from the drawing, how the weighing of the hive No. 1, A, is effected; as by it, it appears the whole frame with the hive in it, is to be suspended from a beam, and I should conceive, therefore, cannot be raised unless such beam be made moveable.

The plate, No. 1, B, is perfectly intelligible to me, and I think the suspending system would be, in many instances, extremely desirable, inasmuch as by means of it hives may be placed in trees, in the neighbourhood of which good bee pasturage abounds, so as to be out of the reach of stock grazing near them, not to mention the convenience of weighing them.

Therefore, Sir, if you will give these enquiries a place in your Magazine, in order to their being answered by Mr. M., or by any other person who has thought of carrying the plan suggested by him into effect, you, and the gentleman giving such reply, will much oblige

AN APIARIAN.

Bungay, Suffolk, May 5, 1831.

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CONVERSION OF FROGS INTO JELLY BY FROST.

Sir,—More than 20 years ago, being on the top of one of the loftiest hills in the neighbourhood of Settle, on a fine clear evening, as the sun was just sinking below the western horizon—it being then about the latter end of March or beginning of April—and the air strongly inclined to frost; on casting my eyes down the eastern declivity, I espied, in a small pond, at the distance of about 20 or 30 yards, the heads of 15 frogs then above the surface of the water. Observing that the pool was very shallow, a thought struck me as I stood—“Where will these animals shelter themselves from the impending frost?” I went down to the pool, and counted the frogs after they had retired from my presence and sunk to the bottom of the water, and I could just count the same number under, as before on, the surface. Having occasion again to pass over the same hill early next morning, I remembered my batch of frogs, and on going down to the pool, it being then thickly frozen over, I found on the margin, and within a few inches of the ice, precisely the same number of little lumps of fine, clear, and nearly transparent *jelly*. I was very much surprised at the circumstance, and turning a few of the lumps over with my stick, I found under each, some small portion of a frog, such as a leg, two legs, or an under jaw, still unchanged. I then passed on, not a little amazed with my observation. In less than an hour I returned by the same rout; I was now still more pleased than before, as I found the conversion complete, not being then able to find the least vestige of a frog remaining. I considered I had seen Dame Nature in the very act of one of her most curious pranks. I communicated what I had seen the same day to a Dr. Sutcliff, of Settle, (possibly Dr. Birkbeck might also hear of this, he being at Settle, for a short space, somewhat near the time). Dr. S., who was one of the most scientific men in the neighbourhood, desired I would take a vial, which he handed me and fill it with the jelly; I did so, and inquired more than once what experiments he had made with it, and remember it turned out, at last, that he placed the vial in a drawer when I gave it to him (he being busy at the time), where it lay neglected for nearly a fortnight, when it was found that the contents were in a complete state of putrefaction, and they were of course thrown away. I have since communicated the circumstance verbally to many scientific characters, who have apparently been astonished with my account; and some I believe have even doubted my veracity.

As I never yet met with any rational account, how a perfect animal should or could be so soon converted into a clear and nearly transparent jelly, I am induced to give the fact to the public through your valuable journal, thereby hoping it may take the attention of some one who will be able to clear up the mystery. I have been asked, whether “the sun shone upon them” on the morning I made the discovery? I answer, I should suppose it had, as they all lay on the west or western side of the pool, being, thereby, as much exposed to the direct rays of the sun, as he rose, as it was possible to be; for, as I observed before, the pool was on the eastern declivity.

I may farther add, that I some years later, made an unsuccessful experiment with a view to throw a little more light on the subject. I went down to a ditch in my neighbourhood, where some frogs were gendering, caught two of them, and having tied a small band to a leg of each of them, I fastened them to a peg, so that I could find them when wanted on the appearance of frost: I afterwards went and took them out, and exposed them to its severity; the night proved very frosty, the *morning very dark;* the frogs were both killed, but no appearance of jelly.

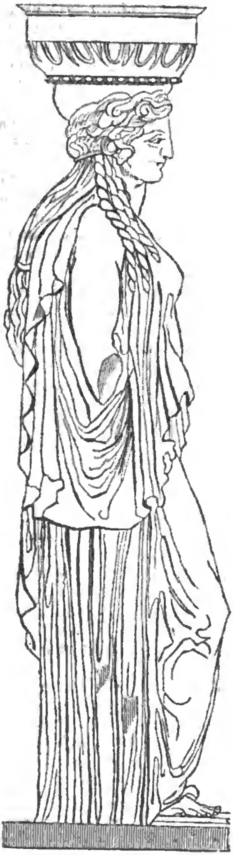
JOHN DUCKETT.

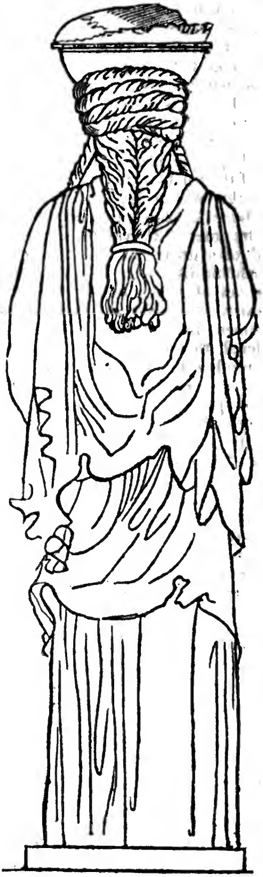
Near Bradford, Yorkshire,
March, 1831.

OF CARYATIDES.

(For the Mechanics' Magazine.)

> "THIS TROPHY HAS BEEN RAISED TO GREECE, ON BEING VICTORIOUS AGAINST THE CARYANS."
>
> *Translation of a Greek Inscription from Stewart and Revett's Antiquities of Athens.*





Sir,—Vitruvius, in his work on Architecture, when treating of the education of an architect, and wishing to show the necessity of historical knowledge, expresses himself to the following effect:—

"Should any one wish for information on the origin of those draped matronal figures, crowned with a mutulus and cornice, it may be explained to him by the following history. Carya, a city of

Peloponnesus, joined the Persians in the war against the Greeks. The latter, in return for the treachery, after having freed themselves by a most glorious victory from the intended Persian yoke, unanimously resolved to levy war against the Caryans. Carya was, in consequence, taken and destroyed; its male population extinguished, and its matrons carried into slavery. That these circumstances might be better remembered, and the nature of the triumph perpetuated, the victors had the Caryan women represented in sculpture, as apparently suffering under the burden with which they were loaded, to expiate the crime of their native city."

That this was good policy in the ancient Greeks, who can deny? With them the order of Caryatides was monumental of a great national triumph.—But I should like to know what there is in the act of exterminating the whole population of a country, and carrying its women into slavery, abstractedly considered, that should make other nations, in other times, desirous of perpetuating its remembrance?—*Christian* nations especially, whose creed it is to "forgive, as they hope to be forgiven;" and with whom all slavery is (or ought to be) an abomination? Such figures as the Caryatides, when divested of the historical recollections associated with them—recollections familiar to a very few only—convey simply the idea of woman in a state of disgraceful servitude and degradation. Need we ask whether a representation of this sort is a fit ornament for the architecture of a free, a civilized, and a humane people?

One of the most flagrant instances of the modern misappropriation of this order is to be seen in the New St. Pancras Church, Euston-square. It is really pitiful, to behold a structure, in other respects of such great beauty, so lamentably disfigured, through mere servility of imitation. Personifications of slavery in its most revolting form, serving as the pillars of a temple sacred to the worship of Him, who came "to set the prisoners free"! Victims of the blind revenge of the heathen, enduring (as it were) a second bondage, at the hands of the enlightened and liberal Christian!!! Was there ever inconsistency so gross or so stupid?

Palladio, with a just disdain, takes no notice of this order in his four books. Ware does include it in his Complete Body of Architecture; but he observes, "that, in *our civilized* times, the hands should not be tied before them, as in the old Greek Caryatic;" and he also lays it down, as an *important* rule, that they should never be burdened with any other entablatures than the Ionic or Corinthian, out of *regard to their sex*. How paltry is this attempt to reconcile to the spirit of modern times, what it is a real disgrace to modern times to copy at all!

Ware (not alone) confounds Caryatides with Canephoræ. He speaks of them as being represented by the ancients with baskets of flowers upon their heads; whereas it is now well understood, that none but Canephoræ were thus sculptured. Besides, in consequence of the latter not being intended to represent bondswomen, and also because of their heads being surmounted by things so fragile as flowers, they were never loaded with heavy entablatures or other incumbent weights, but were used for the ornament of altars and as disconnected statues.

The Grecians employed statues of the Persians (after having conquered them) in the same way as they did those of the Caryans; and generally in connection with a Doric entablature.

In Stewart and Revett's Antiquities of Athens, there is a passage relating to the Caryatides attached to the Temple of Minerva Polias, in which it is said, these are the only ancient examples known of Caryatides being placed for the support of an entablature and roof. They suppose, that it is to this building Vitruvius alludes. The accompanying sketches are copied from the above-named work and temple. The editor, in the second volume of Stewart and Revett observes, that no examples of statues introduced as columns in Grecian architecture, except those of Athens, have remained in their positions to modern times.

In the British Museum, one of these figures may be seen, recently brought from Athens. It is considered, by good judges, to exhibit an elegance of style worthy of the general character of Grecian sculpture, and a monumental grandeur exceedingly appropriate to the columnal intention. On nearer examination, it offers no variation of detail, unobserved by Stewart; and it is thought by some not to be equal, in point of execution, to the fragments of the pediment of the Parthenon. In England there are not many examples of this order, besides the one before noticed. I have heard that there are Caryatidæ employed in the interior of the New Palace, and it is probable enough; for where all is absurdity, it would have been strange if so precious a sample as this had been omitted.—Yours, &c.

B. C. S.

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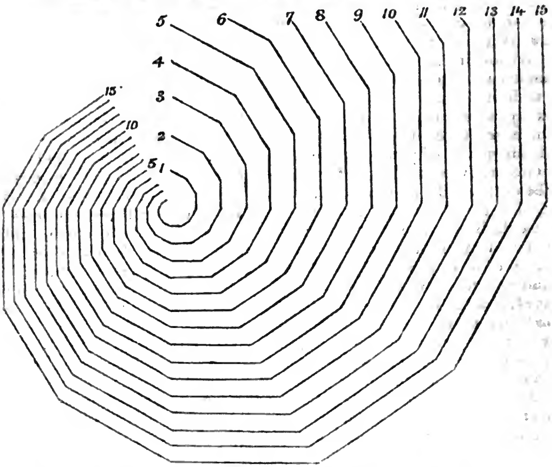
CONVENIENT MODE OF DIVIDING LINES INTO EQUAL PARTS.



Sir,—The above sketch represents a contrivance of my own for dividing lines into equal parts, &c., which, in the absence of proportional compasses, I have sometimes found to be serviceable. If, therefore, you think it worth inserting in your Magazine, it may, perhaps, under similar circumstances, be serviceable to others. Set one point of the compasses in the numerical centre, and turn the other point to the right till it falls upon the line, corresponding with the number required.

Yours, &c.

J. CANSDELL.

London, Feb. 21, 1831.

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HYDRAULIC EXPERIMENTS—REPLY OF TREBOR VALENTINE TO THE ED. "VOCIS RATIONIS."

Sir,—Since it has pleased the Ed. "Vocis Rationis" to express himself in such pathetic terms of condolence over my *unfortunate* letter on the pneumatic problem, you must allow me, Mr. Editor, to state my surprise that any, otherwise well-informed, person can be so *seemingly* ignorant of even the first principles of every branch of mechanical science. I shall now proceed to show the fallacy of the proofs he has so exultingly given of the errors of myself and Mr. Baddeley. It will be seen that the whole of his letter is an indiscriminate jumble of right and wrong; but however he may have deceived himself with a goose-quill, bottle, &c., he may rest assured that he must handle the former in a style much better adapted to the present advanced state of *general* knowledge, before he can hope for any proselytes amongst the readers of the Mechanics' Magazine. With respect to the syphon, it is true, that the water will remain in it while the short end is close stopped, the gravity of the water being overcome by the atmosphere pressing on its surface at the end of the longer leg, at the same time that it presses on the finger only at the short one; which may be sensibly felt by the difficulty of removing it, when there is any considerable difference in the length of the legs. Again, I have no reason to doubt the impossibility of his *sucking* it out; but let him take a syphon, with one leg but just immersed in water and 33½ feet longer than the other, keep it perpendicular, and applying his mouth to the shorter leg, let him suck away, he will suck with precisely the same success as when he stopped the short leg with his finger.

If he is not *yet satisfied*, I would now advise him to bend five or six feet of half-inch lead pipe in the form of a syphon, with both legs of an equal length; having filled it, (if the steadiness of his hand be not impaired by suction) he may hold it up in the air, and it will remain full without the necessity of stopping either end, and must continue so as long as the weight of water is the same in each leg, and both ends are open to the atmosphere; but on connecting one end with the top of the receiver of an air-pump, he will find that a single stroke will so far destroy the equilibrium, as to bring the whole of the water over into the receiver. If he had first stopped the outer end, he would have found it necessary to continue his operations a considerable time, as no water would leave the syphon until the receiver was wholly exhausted, and it would then only be the portion contained in the leg connected with the receiver; the water remaining in the other from the force of gravity alone.

I now come to the upright column of water, or pump part of the question. He says, "water rises of itself in a vacuum through a space of 32 feet." This is any thing but true; it is however true, that water will rise in a vacuum, but not of itself. For instance, at the bottom of the receiver of an air-pump, place a vessel of water, into which put the end of the suction-pipe of a small common pump; make all tight, and exhaust the receiver at the same time. You will necessarily form a vacuum in the pipe, below the pump-clack or bottom-sucker; and let the vacuum be ever so perfect, the water will not rise one single inch of itself; neither can you fetch it by working the pump, even although it should be as good and as perfect as you can desire. What then is the cause of water's rising in a vacuum? As the Ed. "Vocis Rationis" begs to be excused, I hope he will excuse my attempting to clear up these, *to him*, most paradoxical results. Immediately on opening the communication between the receiver and the atmosphere, the water would rush in (if there was a sufficient quantity), fill the pipe up to the valve, although it should be 32 feet high, and that without any assistance whatever from the pump. Having thus got the 32 feet of pump-pipe full of water, (and the means by which it was filled, I think, made pretty evident) we will now suppose the end of the pipe lifted out of the water. Here again he is perfectly right; the contents will not quit the pipe, the whole column remaining as though the bottom of the pipe were plugged, which is sufficient proof that it was not either balanced or supported in any way by the water below. So far we agree; but does not the water in the tube weigh just as much as it would in any other vessel? And has he not the additional weight of the water to lift with the tube? As there is but one answer to these questions, I must now ask—How is this weight of 15lbs. on the square inch supported, but by the pressure of the air? He says it is not! And his *because* is, that the atmosphere presses equally in every direction, consequently that its downward neutralises its upward pressure. Granted; but he has overlooked the *little valve*, commonly but erroneously called the sucker, which sustains the pressure of the air and water that is above it, and of course prevents them from pressing on the upper surface of the column beneath it. Here lays the rub! It is this valve or bottom-sucker that bears the downward pressure, whilst the upward pressure confines the water in the tube, as we have already seen; only let him by opening the valve allow the air to press on the top, as it does at the bottom of the column, and I need not say what will occur.

I will now examine how far he is right in his sober calculation. Taking the diameter of the piston at 4 inches, (the weight of a gallon of water we have nothing to do with) and in this instance we may either take the weight of a 32 column of water, or the pressure of the atmosphere, they both being 15lbs. to the square inch; the pressure on the piston is therefore 188⅛lbs. and which has most certainly to be overcome at every depression of the pump-handle; so that we see it is a positive fact, that it would take a little more than 23⅛ stone to balance the pump-bucket! But he should not have stopped here; he should by all means have taken the *pump-handle into his calculation.* It being a lever of the first order, of (say) 6 to 1, it reduces the force required to depress the handle to 32lbs. which is again reduced about one half by the weight of the lever itself. He asks how could a pump-handle fall by its own weight, if it had a bucket so loaded suspended at the other end? I answer, that it never yet did so, of which he may satisfy himself, by preventing the fixed valve from closing, thereby throwing the whole of the weight or pressure on the bucket,* when the handle if down will immediately rise, and remain up as long as the bucket holds good, or until it is brought down by a superior force. At the same time it is true, that the handle of most common pumps will, when lifted up, fall by their own weight; but as they expel no water, it is a proof that instead of lifting the weight, all the water that lay above escapes past the bucket. His remarks are good respecting the increase of labour by too small a suction-pipe, &c.

In conclusion I will just remark, that in calculating the force or pressure on the bucket, the only true way is to take the weight of a column of water the entire height from the surface of the water in the well, up to the discharging orifice, and of the same diameter as the bucket, which will be correct for all heights, leaving the pressure of the atmosphere altogether out of the question; for although a pump on the common principle will not (as we have already seen) work without it, yet having the vacuum to form before it can be taken possession of by the water, we have to lift every ounce of water discharged at the spout.

Yours, &c. TREBOR VALENTINE.

Derby, May 2, 1831.

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APPLICATION OF THE KITE TO VARIOUS USEFUL PURPOSES.

Sir,—It has often surprised me that more use has not been made of the great power which may be obtained by elevating kites in the atmosphere, where they remain suspended by the force of the wind. Hitherto (with one or two exceptions) they seem to have been devoted to the amusement of schoolboys: but from some circumstances of late occurrence, and a few experiments which have been made, I am inclined to think they might be turned to very material use, particularly in nautical affairs. Kites of large dimensions, it is well known, may be so constructed as to rise in the air with a very light wind; and, if due attention be paid to their manufacture, they may be made extremely light and portable, and at the same time possessed of considerable strength and durability. Instruments of this kind, about 15 feet long and of a proportional breadth, might be so adapted with hinges, &c., as to fold up into a very small space, and many of them could be packed in a box of moderate size. I would recommend, that ships going to sea should be provided with several boxes filled with these machines. And the following are some of the advantages which I conceive would arise from their use. In giving chase or being pursued, when a vessel can carry no more sail, many of these machines might be elevated into the air, communicating an immense additional impetus without any increase of danger; for the power derived from kites would be very different in its application from that arising from a heavy press of sail; the tendency of the latter is to run the bow of the ship under water, and the risk of oversetting is very great, arising from the length of the masts, which are so many powerful levers on which the sails act. Now, kites attached near the bow would tend to raise the vessel out of the water, an advantage which seamen can well appreciate; and as they would act, not on a lever but on the deck, or even below it, if necessary, it would be impossible to overset the ship, as far at least as the kites are concerned. Indeed, their power may be so applied that the lee-side would never be lower in the water than the weather. Another advantage is, that the draft of heavily-laden vessels would be lightened by their judicious application.

It is well-known also, that at the elevation of a few hundred feet above the level of the sea, currents of air often pass in directions different from that of the wind at its surface; of these advantage might be taken when contrary winds prevailed below. By some experiments lately made with a boat navigated by a kite, I understand it was found, that by properly applying the point of traction of the kite, the vessel could be made to sail much nearer the wind than by any method of rigging yet known. In action, gaining what is called the weather-gage, is an important advantage: the wind is taken out of the sails of the adversary, and she lies in a great measure powerless. This would be removed by the application of kites; for being elevated at different heights in the atmosphere, a circumstance of this nature could not occur. Besides, when the masts are shot through, a misfortune which often occurs, the vessel is left entirely at the mercy of the enemy; but kites would be out of the reach of shot, and the ropes by which they are suspended, present so small a surface that they are unlikely to be injured; or, if they were, other kites could be immediately supplied.

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* On the working of the pump this weight is regularly transferred from bucket to clack, and from clack to bucket, as the handle is raised or depressed.

It often happens, that vessels under the shelter of the land are nearly becalmed, while those at a short distance are enjoying a favourable breeze and proceeding on their destination; this also might be obviated by the use of kites, elevated so as to catch the wind over the land. In beating against the wind in a confined channel, the advantage of kites would be very great: for, in wearing the ship, according to the present method, when her head is brought direct to the wind, she retrogrades considerably, the sails acting powerfully upon the masts, till her head comes round; but the ropes of a kite may be so adjusted, that at the moment of the ship's turning, it may be made to lie horizontally on the air, and so its power for the time would be destroyed, and the distance of its fall during the momentary operation could not be great.

The above ideas have occurred upon a hasty consideration of the subject; the correctness of some of them has been already proved experimentally; and I shall be happy if these observations may meet the eye of any of your intelligent and enterprising readers: who, having more leisure than I, may give the thing a fuller consideration and more extensive trial.

Might not Captain Parry have had a better chance of reaching the Pole, had he employed kites to waft his sledges along, than the means he used on his last attempt? A favourable gale might have been waited for, and two or three days would have sufficed to have carried him from the place where the ships were left, to the object of his desires. The sledges might have been constructed so as to be capable of crossing the ice, and also of traversing the lakes and channels of water by which it was intersected, increased weight and bulk being no great objection in this case.—Yours, &c.

Rend.

Belfast, March, 22, 1831.

WOOD ON RAILWAYS.

(Continued from our last Number, p. 176.)

The employment of the expansive power of steam to propel wheel-carriages (in this case it can *only* be employed expansively), appears to have been first suggested by the late Professor Robison to Mr. Watt, as early as 1759; but Mr. Wood awards to Messrs. Trevithick and Vivian the praise of being the first to carry that suggestion into effect. "It is to Messrs. Trevithick and Vivian," he says, "that we owe the introduction of the steam-engine acting solely by the expansive force of steam." In 1802, Messrs. T. and V. took out a patent for the application of an engine of this sort to the propulsion of carriages; and in 1804, they exhibited a steam-carriage at work on the Merthyr Tydvil Rail-road. Mr. Wood takes no notice of the rival claims of the American engineer, Oliver Evans; and unless we are to suppose that he has done so from ignorance of their existence (which would not say much for his reading), he must be pronounced to have therein done great injustice to a most enterprising and meritorious individual. Evans conceived the project of employing steam as a locomotive-power on land as early as 1772, (and with him the conception has every appearance of being perfectly original); he obtained an exclusive right to make and use steam-waggons, from the State of Maryland in 1787, that is, fifteen years before the date of Messrs. Trevithick and Vivian's patent; and in 1804—the same year that Messrs. Trevithick and Vivian first exhibited their carriage in action—Evans gave a similar experimental demonstration of the practicability of steam-travelling in the streets of Philadelphia. Nay, so well did Evans appreciate from the first the great capabilities of this new locomotive agent, that he at one time offered to make a steam-carriage that "would run on a level road with the swiftest horse;" and at another, to furnish steam-carriages that would "run at the rate of fifteen miles an hour on good level railways;" which, practicable though it is now shown to be, is more, we apprehend, than Trevithick and Vivian, or Watt, or Robison, or any other person besides Evans himself, dreamt of, at any time during the last century. We feel confidently persuaded, that had Evans only been supported by his countrymen as he deserved—instead of being derided and neglected, as he unfortunately was—the Americans would, through his instrumentality, have had the start of us in steam-travelling as decidedly as they have had in regard to steam-navigation. An enthusiast Evans certainly was, but an enthusiast of the right sort; one whose imaginings consisted simply in deducing from sound principles, new yet sound conclusions, and whose ill-requited perseverance in endeavouring to bring his plans to a successful practical issue, was but the natural fruit of a rational and unalterable conviction that they had truth for their basis.

It was in 1804, that the exhibition on the Merthyr Tydvil Railway took place; but no less than ten years elapsed before any considerable advance can be said to have been made in the application of steam to locomotion on land. The "great obstacle" in the way, is said by Mr. Wood to have been "the supposed want of hold or adhesion of the wheels upon the rails, to effect the locomotion of the engine." Not that any want of adhesion had been actually experienced by any one; people generally *supposed* that such would be the case, and that was all. We have here, a striking instance of the serious injury, which often arises from the habit of taking for genuine and authentic, every thing that passes current in society. Had but a single experiment been made to ascertain whether "want of hold or adhesion" was *really* the sort of obstacle which it was *supposed* to be, some ten or fifteen years of inventing and contriving to overcome that obstacle would have been saved, and the talent and ingenuity thrown away on the visionary pursuit, might when applied—as it would have been—to a removal of the real difficulties of the case, have gained for us, just so many years' march on the road of improvement.

In 1811, Mr. Blenkinsop, of the Middleton Colliery, near Leeds, took out a patent for the application of a rack or toothed rail, into which wheels turned by the engine were to work, and *thus* produce a progressive motion; and shortly afterwards he erected some engines on this plan on the Middleton Colliery Rail-road. They worked well, and to this day they continue to work well. Indeed, there never could or ought to have been any doubt on the subject. For the conveyance of great weights, the rack-rail must manifestly have an immense advantage over every description of plain rail; no *gripe* by mere adhesion of surfaces can ever match the gripe of a good set of teeth. Mr. Gray, of Nottingham, has strongly advocated the adoption of a mixed railway system—plain rails for speed, and toothed rails for heavy weights; and we incline to the opinion, that when economy comes to be more regarded by railway proprietors (as it will be ere long), this is the system which will be found most advantageous in practice. Mr. Wood never mentions the writings of Mr. Gray; and in this we think he has been guilty of another remarkable omission.

The first person who seems to have thought it worth while to ascertain, by actual experiment, how much locomotive power could be obtained by simple adhesion, appears to have been Mr. Blackett, of Wylam.

> "About this time (1813) Mr. Blackett had considerably improved his engines (on the plan of Mr. Trevithick), and by experiments had ascertained the quantity of adhesion of the wheels upon the rails, and proved that it was sufficient to effect the locomotion of the engine upon railroads, approaching nearly to a level or with a moderate inclination. His railroad was a plate rail, and would consequently present more friction or resistance to the wheels than an edge-rail; and on that account, the amount of adhesion would be greater than upon the latter rail; still the credit is due to Mr. Blackett, for proving that the locomotion

could be applied by that means alone. The first attempt of Messrs. Trevithick and Vivian failed; and though this was no doubt owing to the imperfect construction of the engine, yet it appears that the cause was nearly, if not wholly, attributed to the want of adhesion to obtain locomotion; and hence we find the engineers attempting to produce other means of locomotion—Mr. Blenkinsop, by means of a cog-rail; Mr. Chapman, by a chain; and Mr. Brenton, by means of moveable legs. It was, however, a question of the utmost importance to ascertain, if the adhesion of the wheels of the engine upon the rails were sufficient to produce a progressive motion in the engine, when loaded with a train of carriages without the aid of any other contrivance; and it was by the introduction and continued use of them upon the Wylam Rail-road, that this question was decided; and it was proved that, upon rail-roads nearly level, or with very moderate inclination, the adhesion of the wheels alone was sufficient in all the different kinds of weather, when the surfaces of the rails was [were] not covered with snow. Mr. Headley informs me, that they first tried by manual labour how much weight the wheels of a common carriage would overcome without slipping round upon the rail; and, having found the proportion it bore to the weight, they thence ascertained that the weight of the engine would produce sufficient adhesion to drag after it upon the rail-road a requisite number of waggons."—pp. 132—134.

The engine constructed by Mr. Trevithick had one cylinder only, with a fly-wheel to secure a rotary motion in the crank at the end of each stroke; and so, for a long time, had all the engines on the Wylam Railway. The disadvantages attending this mode of construction were very great:—

"When the engine was stopped, and the crank and connecting-rod in the same line, the power of the cylinder had then no effect in turning the crank round, and the engine had to be moved by levers applied to the spokes of the fly-wheel, until the crank formed such an angle with the connecting-rod, that the engine got sufficient power to produce a rotary motion, and propel itself forward. This occasioned frequent delays, and the irregular action of the single cylinder produced jerks in the machinery, and had a tendency to shake the machine in pieces." —p. 134.

The merit of obviating these serious difficulties belongs to Mr. George Stephenson. In the early part of 1814, an engine constructed by him was tried on the Killingworth Colliery Rail-road, which had *two* cylinders, and *two* cranks, worked alternately by means of two rods in connection with the pistons, and these cranks were so placed with respect to each other, that when one of them was perpendicular, or in a line with the connecting-rod, the other was horizontal and at right angles with it; by which means, a continuous rotary motion was kept up. This motion was transferred from the cranks to two small cog-wheels under the frame of the carriage, which, worked into two larger cog-wheels fixed on the axles of the carriage-wheels; and so made the wheels go round. The first trial with this engine was made on a piece of road, with the edge-rail ascending about 1 in 450; and it was found to drag after it, exclusive of its own weight, eight loaded carriages, weighing altogether about thirty tons, at the rate of four miles an hour. It continued afterwards regularly at work.

It was subsequently suggested by the late ingenious Mr. Ralph Dodd, that the motion of the pistons might be transferred directly to the wheels without the aid of the intermediate cog-wheels. He proposed, that each connecting-rod should be attached by a ball and socket joint to a pin on one of the spokes of one of the carriage-wheels; and he assumed, that "by these means the reciprocating motion of the piston and connecting-rod would be converted by the pin upon the spokes, acting as a crank, into a rotary motion;" and that all that was necessary to secure a continuation of this rotary motion, would be to keep "the one pin or crank at right angles to the other;" various modes of doing which he pointed out. A patent for this improvement was taken out by Mr. Dodd, in conjunction with Mr. Stephenson; and an engine so constructed was tried on the Killingworth Rail-road, on March 6th, 1815, which, Mr. Wood informs us, was "found to work remarkably well."

Indeed, no better mode of transferring the power of the engine to the carriage has yet been devised, and it is that which is now (we believe) universally followed.

Notwithstanding these and other subordinate improvements, ten years more passed away, before we had advanced farther than the employment of steam-carriages to convey coal, and other heavy articles, at very slow rates of speed. The causes which now arrested the march of improvement are succinctly explained in the following extract. The author is speaking of engines such as they were in 1825, with a single, or, at most, double tube, and constructed in the best manner.

"In 1825, the power of these engines was rateable at about 40 tons, conveyed six miles an hour; at this period they were not therefore adapted for great rates of speed. Their power being in strict proportion to the area of evaporating surface, it follows that to obtain a greater power of engine, we must either increase the area of evaporating surface, or produce the same effect by an increase in the intensity of the fire. In the old form of engines, the single or double tube formed almost insuperable obstacles to their improvement, for if we increased the size of the tube, it increased the weight of the engine; and an increase in the intensity of the fire could only be effected by a waste of fuel, already disproportionably great by a want of a proper area of heating surface. Accordingly, we find that so long as the formation of the steam was effected by boilers with a single or double tube, the improvement of these engines, and their adaptation to quick rates of travelling, made little progress. Upon the Darlington Railway an engine with a much greater evaporating surface of boiler was applied, but the weight was proportionably increased so as to render the employment of six wheels necessary."—P. 356-57.

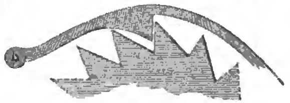
At length, there came the Great Locomotive Competition of 1829, and with that the introduction of multi-tubular boilers, by means of which chiefly, all the late wonderful performances on railways have been achieved. But the details of that competition—at least so much as there is new in Mr. Wood's statement of them—we must reserve for a further continuation of this article in our next No. Suffice it, for the present, to observe, that Mr. Wood's narrative appears to us to be drawn up with great fairness and impartiality; and, in consequence of his holding the official situation of one of the Judges on the occasion, is necessarily more circumstantial and authentic than any other that has yet appeared.

(*To be continued in our next.*)

MINOR CORRESPONDENCE.

Mr. Baddeley's Improved Ball-Cock.—Sir,—A slight alteration made by the engraver in the representation of my improved ball cock, (No. 405) has unfortunately rendered it quite unintelligible.

A portion of the ratchet-wheel and lever taking into it, annexed, will explain how the disengagement takes place. *No disengagement could take place*, with such an arrangement, as that introduced by your engraver at p. 161.



Yours, respectfully,

WILLIAM BADDELEY,

London, May 14, 1831.

Sir,—I have my doubts that Mr. Baddeley will find several obstacles in the construction of his ball-cock, which would preclude it from answering if put into use. I will offer one to his consideration, and if it will hold good, it quashes the invention. The spheroid E must be of such weight as will hold the ball D at its lowest depression until the water rises to *f*. Now, the ball D will have a tendency to elevate as soon as the water arises round it, and it will progressively increase till the water reaches *f*. *Query*—will the spheroid of such a weight rise on the fluid reaching the necessary height? My other objections might be answered satisfactorily; they do not seem to my mind so important as the foregoing, and as they would take some space to describe, I shall refrain from mentioning them. If the one named can be met by a *practical* rebut, I think it likely that Mr. Baddeley's idea may be rendered very useful in meeting the difficulty which at present exists, and which it is intended to remove.—Yours, &c. T. M. B.

Light from Lime.—Sir, There is an important chemical property of lime mentioned in the Part of the Mechanics' Magazine for March last, p. 27, in an article on the lighting of light-houses. The property to which I allude is that of evolving intense light when submitted to a flame of hydrogen gas, urged by a stream of oxygen. I beg to propose the following queries on this subject, and should feel much obliged if any of your correspondents could answer them. How is sufficient coherence given to lime to form a ball or a cylinder? Does the hydrogen gas require to be pure, or has the ordinary carburetted hydrogen from coal the same effect? Has the invention been adopted in the lighting of streets, shops, and other places, where common gas is used?

Yours most obediently,

R. M. AN OLD SUBSCRIBER.

May 5, 1831.

INTERIM NOTICES.

Communications received from Mr. Harrison—A Constant Reader—N. B.—Mr. Utting—D. W.—A Looker-on.

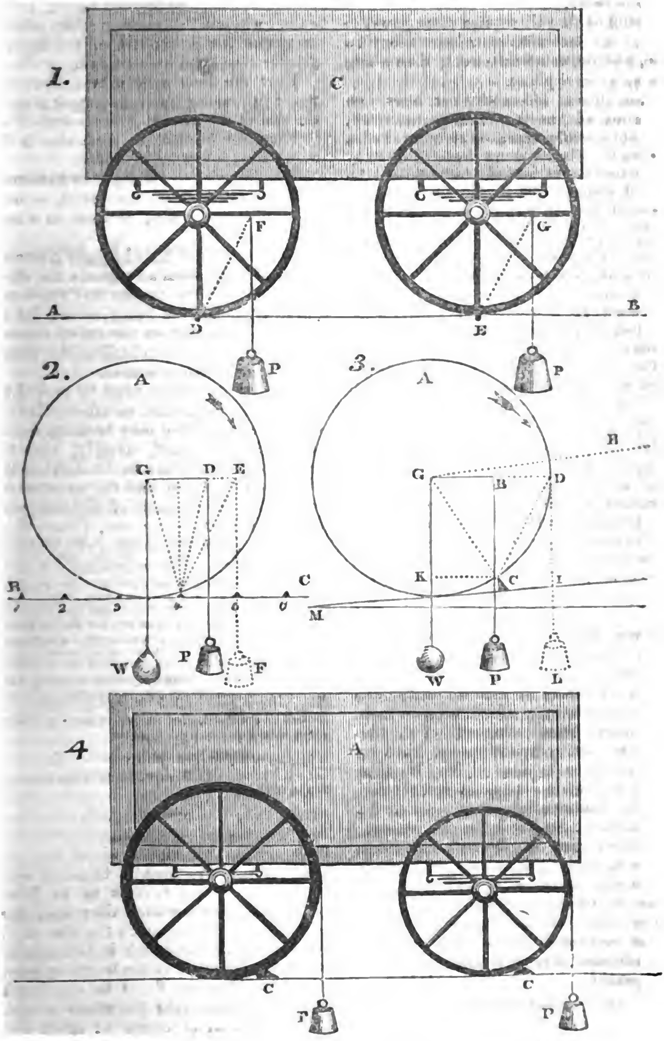
LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 407.] SATURDAY, MAY 28, 1831. [Price 3d.

THE "TRIUMPH" STEAM-CARRIAGE.



PRINCIPLES OF THE TRIUMPH STEAM-CARRIAGE—SAXULA'S NEW THEORY OF LOCOMOTION.

Sir,—My twelve propositions, inserted in No. 397, p. 44, being admitted, I proceed to prove,

1st. That it will require more power to propel a locomotive-carriage along a rough plane, or up an ascent, than along a smooth level plane.

2nd. That locomotive-carriages on plain wheels, as at present constructed, cannot possibly travel over a level of a certain roughness, or up the hills of common roads; in proving which will be unfolded the new theory of locomotion.

3rd. That the Triumph steam-carriage is constructed on the only principles that will enable a locomotive-machine to surmount the hills and obstacles of common roads.

My *first* problem I know needs no proof, but I shortly demonstrate it for the sake of what is to follow.

Let AB, fig. 1, represent a perfectly smooth hard and level surface (to which an iron rail-road only approximates). Let the carriage-body C be considered as 1 ton, or 10 cwt. on each pair of wheels, 5 cwt. per wheel, the wheels are all supposed to be perfectly round and smooth. The four wheels will then touch the smooth plane in four minute points, DE being two of them, and these points will all be perpendicular under the centres of the axles, forming both before and behind the wheels right angles with the plane; there are no obstacles on either side the wheels, no fulcrums for the weights to be lifted over (Prop. 8.) In fine, the four wheels and their weights (considering them as weights going to be acted on by levers) are each on its several fulcrum (Prop. 10.) Then let the power PP (Prop. 5) be applied to what part of the wheel-spokes it may, (Prop. 9) it will act on the long arms of levers DF·EG infinite in length as regards the short arms; for the short arms being nothing, (Prop. 10) an infinity of nothings can never make the smallest fraction of an integer; but if the least obstacles be put on the plane under the wheels, suppose in front, they will become fulcrums in advance of the weights, (Prop. 8) and the short arms of the levers will then have some relative length, and more power will of course be required (Prop. 6) to raise or propel the weights than before, which was to be proved. The conclusions to be drawn from this proof are:—

That the smoother and more level the road is, the less will be the power required to propel a given weight; and as that power may be applied nearer to the axle, without shortening the relative length of the power-arm of the lever, a greater speed can be obtained.

That the long arm of the lever can never in practice be made longer than to the rim of the wheel.

That the friction on the axles is the only resistance to be overcome.

That locomotive-carriages on a common road can never attain the speed, or near to it, with like power, of those on a raiload.

That the size of the wheels on a smooth plane is immaterial as regards the effect of the power to overcome any resistance on the plane, there being none; but as regards the friction on the axles, the size of the wheels is of considerable consequence: of which hereafter.

My *second* problem must be proved by a deeper investigation, but the following inference in aid of it may be fairly drawn from the first proof, namely, that the nearer the weight can be brought to the fulcrum, (Prop. 10) and the greater the proportion can be made of the long arm of the lever to the short one, (Prop. 6, 9) the more easily the weight will be lifted and propelled. On a perfectly smooth and level road all would be ease and rapidity with locomotive-carriages mounted on friction-wheels; but as no such roads are made, our affair lies only with surfaces more or less rough, and as we cannot make perfectly smooth roads, we must make machines for rough ones.

Let A, fig. 2, represent a loaded locomotive wheel, 1 ton in weight, whose centre of gravity is in the line GW (Prop. 7); let BC represent the plane of a level road, having upon it the obstacles or inequalities, 1, 2, 3, 4, 5, 6. Now, however small these inequalities may be, they will impede the motion of the wheel forward, and severally become a fulcrum over which the weight GW is to be lifted (Prop. 8); the smaller they are, the nearer they will approach the line GW, but they can never touch it, because the line GW is already in the touching point with BC. Suppose No. 4 be one-fourth part of an inch high, the whole weight, or 1 ton, must of course be lifted that height, and by Prop. 12, a power equal to a weight of 1 ton (Prop. 5) must, to raise it, descend the same space upon an equal armed lever G 4 D, or half a ton a double space upon a 2 to 1 armed lever G 4 E (Prop. 6); and by the same proposition, the nearer the line of power DP approaches to No. 4, the greater the power requisite to lift the wheel. But by Prop. 10, when the line of power arrives at No. 4, it is on the fulcrum (Prop. 8), and lost as far as regards lifting the weight over the obstacle. No. 4. I shall speak of momentum hereafter, which is a power of another kind, and acting in another direction. I have supposed the obstacle in fig. 2 to be one-fourth of an inch high; good common roads are full of such, and bad roads from that size to 2 inches and more. As we cannot divest the roads of these hindrances, we must build our machines on principles to encounter them, which has not been done. The idea seems to have been, "Let us but make power sufficient to turn the wheels round, and they *must* go forward.

A horse has greatly the advantage of machine locomotive-power, as his line of draught is in a different direction, and generally, though not always, operating upon a more powerful lever. Let GW, fig. 3, represent the weight or centre line of gravity of the loaded locomotive-wheel A (Prop. 7); let MI represent the plane of a hill; C, an obstacle on that plane (Prop. 8); GH, the line of a horse's draught or power; and P, a power equal to a weight, (Prop. 5) hung on the spoke or crank at B. Now, it is quite plain, from what has been before proved, that the power P can never raise the weight W over the obstacle C (Prop. 10). It is plain at sight, for the power is beginning to act, as it were, on a lever of the third order GC; and if either G or C be moved by the power, they must be moved backward. The wheel may turn round, or the spokes be twisted out, but it cannot go over the obstacle C; but were the power shifted to D, the maximum, acting in the direction DL, then C would become the fulcrum of a bent lever GCD between the power and the weight, and W would be lifted over, and the wheel roll on (Prop. 6). Again, suppose a horse to be drawing in the line GH—he is exerting his power at the long arm of a lever GCK, nearly equal in length to the radius of the wheel GC (Prop. 11), the short arm being the distance of the fulcrum from the line of gravity or CK. Here the horse has the advantage of a lever apparently about 2 to 1, whilst the machine power lever of the same order is as nothing to infinity; such is the difference in this case. It follows, that horse-power has greatly the advantage of equal machine-power in steep or rough ground, as the horse rises with the hill, and still draws in the line GH, fig. 3, (Prop. 11) having the length of the spoke GC for his lever; on the contrary, as the hill or obstacle rises, the power-arm of the lever of the machine shortens by the fulcrum coming nearer to IC, and receding from the weight CK. Three living horses will do as much up a steep hill as 4½ mechanical horses' power of equal strength per horse. This forms the grand difficulty to the progress of locomotive-carriages on rough or steep ground. The greatest mechanical lever GD or KI being only equal to the horse-lever GC or wheel-spoke on a level plane; and this difficulty can only be partially counteracted by using large wheels, under which obstructions cannot get so proportionally near to the circumference or line I, which is the extremity of the power-arm of the lever.

I may here stay to note a great peculiarity in the action of locomotive-power on wheels. When about to pass an obstacle that it can surmount, the power acts on a lever of the first order. As soon as it has passed the apex of the obstacle, the lever changes to one of the second order; and when it arrives at some obstacles that it cannot surmount, the power acts on a lever of the third order. Thus locomotion on common roads is performed by levers ever varying in power and in class; whereas common machine-motion is performed by a series of levers unvarying from their first arrangement.

It now becomes necessary to ascertain the reason why the wheels of locomotive-carriages are propelled at all over obstacles or up ascents, and do not rather turn round in the places where they stand? It is by reason of an interlocking, or adhesion of surfaces, called friction (Prop. 2).*

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* So little have experienced engineers known hitherto of the theory of locomotion, that friction, which is a great mean of producing it, has been accounted the main hindrance to its success. I could find many such opinions in your pages, (see one in vol. xiii. p. 75) though there are also others of a contrary opinion. The retarding friction is the axle

Friction is an ascertainable, variable, limitable quantity, and may aptly be illustrated by supposing a loaded locomotive-carriage with cogs on the rims of the wheels, mounting an ascent by cog-rails made of wood or brittle material. The load or the ascent may be increased, and the carriage will still get on, as long as the teeth of the rails hold unbroken; but when the load becomes too heavy for the strength of the wood, the teeth or cogs will break off, and the carriage will no longer mount, although the locomotive-power may still turn the wheels round. Just so with friction: a load will hold to mount an ascent so long as the friction will hold: but by Prop. 3, friction may be one-third the weight of the body; and by Prop. 1, the sine of the angle of inclination of the hill denotes the power of descent or weight to be raised; and by Prop. 4, that power of descent must be greater than the friction, before the body will descend. Therefore, I conclude that it is possible for a body to be moved by locomotive-power up an ascent rising one-third, or 1 in 3, by only the hold that friction gives; and this conclusion I can safely say is fully warranted by experiment. Hence it follows, that to give the greatest hold, the greatest friction must be resorted to, which being various in various surfaces, such various surfaces must present various facilities of ascent, from the least to the greatest possible friction between such surfaces. Glass wheels on glass planes will ascend very slight inclinations, wood wheels on wood planes will ascend very steep ones; thus the ability to ascend is limited by the friction. The best combination of these qualities of friction, and the before-named powers of leverage, give the perfection of locomotion. I have before proved that the powers of leverage are ascertainable and limited by the circumference of the wheel, and I have said that the friction is ascertainable. Let us inquire how?

Let a carriage be placed on a plane of any description; let all the wheels be locked, or prevented from turning round (for if they turn round, it will be the friction between the naves and axles only, not the friction between the wheels and the plane that will be the object of calculation); then let the plane be elevated at one end, until the carriage *slides* down. The angle of elevation of the plane will show the limit and quantity of the friction on that plane (Prop. 1, 4); every description of plane and wheels will vary from one another; and that elevation will be the limit, or somewhat exceeding the limit of ascent of that carriage on that plane, under the most favourable circumstances. By Prop. 3, the friction or hold increases as the weight of the carriage increases; but by Prop. 1, the power of descent, or pull at that hold, increases also with the weight in like proportion; so there is no means of availably increasing that hold but by changing the surfaces of contact, for other surfaces having in their nature a greater friction or hold; and when surfaces having the greatest friction are resorted to, the hold of course becomes a maximum.

The power of descent being equal to the sine of the angle of elevation, (Prop. 1) the power of ascent must of course be somewhat more, or the body will not move up (Prop. 12); and it has been proved that friction will hold a body on an inclined plane until the power of descent is equal to that friction.

Suppose the maximum of ordinary friction on plain wheels be assumed at about the sine of 20°:* then any hill to be ascended must always be less than 20°, and any obstacle on a level plane must form with the wheel an angle of less than 20°, (Prop. 8) otherwise the power of descent will overcome the friction.

I have said before, that large wheels must be used to facilitate the progress over obstacles. I think it plain enough, without especial proof, that an obstacle of a certain size will form a greater angle under a small wheel than under a large one; therefore, an obstacle that would be equal to an ascent of 30° under a small wheel, may be made equal to an ascent of only 15° under a large wheel. Consequently, large wheels will surmount by locomotive-power obstacles that small wheels cannot; and thus the use of large wheels both reduces the angle of eleva-

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friction only, which I presume will remain the same on all roads; and the main hindrance is the perpendicular elevation of obstacles in succession.

* It is stated in vol. xiii. p. 152, that "arches may be turned to the extent of 30° of inclination without any centre whatever, for the arch-stones or voussoirs at that angle will not slide." There is no real necessity for cog rails, or any extra friction apparatus, to enable a carriage to mount any moderate steep, but there may be an expediency in using cog-rails in some cases, which may give them a preference.

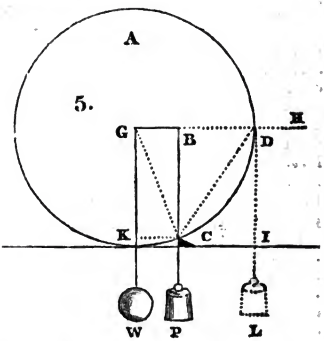
tion of casual obstacles, and gives facilities for the employment of a more powerful leverage.

I think I have now premised sufficient to establish my *second* problem.

Let A, fig. 4, represent a locomotive-carriage weighing 1 ton, independently of the four wheels on which it rests, which we will suppose to be 3 cwt. each for the hind-wheels, and 2 cwt. each for the fore-wheels—30 cwt. in all. Let the body of the carriage rest so as that each wheel shall bear 5 cwt. It is plain, then, that each hind-wheel presses 8 cwt. on the plane, and each fore-wheel 7 cwt. Let CC represent obstacles under all the wheels, equal to a hill rising 1 in 5 (Prop. 8). The power of descent of the carriage in going over those obstacles will then be one-fifth of the whole weight or 6 cwt. (Prop. 1) and the required lifting or propelling power PP will be more than 6 cwt. (Prop. 12.) Now, if this power be applied to or divided amongst all the wheels, it will embrace all the friction or hold which they have; and supposing the friction to be one-third of the total weight, (Prop. 3) the hold will amount to 10 cwt., being 4 cwt. more than the power of descent, consequently the carriage can go over the obstacles; but if the power of 6 cwt. or more be applied to the two hind-wheels only, their hold or friction is only one-third of 16 cwt. or 5⅓ cwt., and being less than the required power, they will slip round, and not go over the obstacles.*

This proves, generally, that all the locomotive-carriages which have the weight on 4 wheels and the power applied to only 2, can never ascend a hill requiring more power (calculating from the power of descent) than the amount of friction of those two wheels. Hence is to be drawn these two conclusions with respect to the friction when a maximum of effect is wanted, either that power must be applied to all the wheels in proportion to the loads they bear, or that the two wheels to which the power is applied must carry all the weight or nearly. The greater the departure from this principle, the greater will be the failure in rough or steep ground.

So much for friction, now as regards the application of the power.



Let A, figure 5, represent one of the wheels, about 5 feet diameter, of a loaded locomotive carriage—I mean those wheels only to which the power is applied, by cranks on the axle, or pins in the spokes. Let B represent the cranks, 9 inches radius, being a customary size, and P the power attached thereto. Now, if the carriage when going on a level road, meet with a succession of stones, ruts, or hills, amounting to a resistance of 1¼ inch high, represented by C, and such a succession as is sufficient to destroy or exhaust any previously-acquired momentum, the power P, will then be exerted on the fulcrum C, of the imaginary bent lever, B G C K (Prop. 8, 10), and, however great that power may be, it can never raise or propel the carriage or weight represented by W, over the obstacle C.*

But were the power applied at D, say DL, equal to a lever ICK, or DCG, the weight would be raised as before proved (Prop. 6). Such is the difference of horse draught, that a horse would not draw against the fulcrum, until the obstacle reached as high as D, or was equal to the semi-diameter of the wheel, and any momentum which a carriage has acquired is equivalent to a power acting in the direction GH, consequently very superior in passing obstacles to a power in the direction BP.

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* Mr. Herapath, in his letter to the Duke of Wellington respecting Mr. Gurney's steam-carriage, caught a glimmering of this fact, but he let it run wild until it broke all bounds. And the engineers of the Manchester and Liverpool Railway have applied it in improving the powers of the engine Samson.

* This is the case I had in view, when in my first public letter on this subject, in 1828, I said, that steam-carriages were built on "principles demonstrably as erroneous and inefficient in mechanics, as those of the strong man, who ventured a wager that he could lift himself off the ground in a basket wherein he stood."

The powers of traction must be estimated by the same principles; for whether a tractor locomotive-carriage have a certain power of descent down an inclined plane by reason of its own weight only, or by reason of its weight and something pulling behind jointly, the same laws and principles of friction and leverage, apply in trying to produce motion up the plane. Suppose a steam-tractor carriage, constructed on the above principles, weigh 40 cwt., and it be upon a smooth road, where its friction on the road is 12 cwt., or not quite one-third. Again, admit that this road be so little elevated, or so free from obstacles, as in a rail-road, that $\frac{1}{20}$ or a 2 cwt. power, will overcome both the power of descent and the rubbing of the axles, and so propel the tractor:—there then the friction 12 is only lessened by about 2, leaving 10 cwt. of friction, for the power of descent of any train of carriages behind to pull at; and as the power of descent upon this road has been before stated at $\frac{1}{20}$, the tractor will barely draw 20 times 10 cwt., or 10 tons, before the engine power will make the wheels of the tractor turn round without advancing. Now, any succession of small obstacles, or increase of elevation, will destroy its power of traction with this load, and it will be useless to increase the engine-power of ascent, nothing will do but lessening the load, that is reducing the power of descent below the friction (Prop. 4); and this reduction must continue, and be repeated with the increased elevation of the road, until the power of descent of the tractor itself only becomes near 12 cwt., when it will draw nothing, and be barely able to ascend alone. I have now, I believe, established the following principles:—

PRINCIPLES.

1st.—That locomotive-carriages derive their power of being made able to ascend any hill on plain wheels, from the quantity of friction between the material of the wheels and the material of the road.

2nd.—That the friction must be a maximum to give a maximum of effect, either in ascending or dragging a load, and that friction is a maximum on any point, when the whole weight rests on that point.

3rd.—That no friction is available, or can be reckoned, except that of the wheels to which power is applied.

4th.—That locomotive-power is of the greatest effect, or a maximum, when applied to the rims or circumferences of the wheels. (DL, Fig. 5.)

5th.—That locomotive-power on a wheel has no propelling effect, or is a minimum when a perpendicular let fall from its horizontal radius, (BP. Fig. 5), touches or falls within the opposing immoveable point, or C. Fig. 5.

I had to prove my second Problem, which I do thus—Locomotive-carriages are at present constructed, with wheels of about 5 feet diameter or less, and the power applied to cranks, or equivalent machinery of about 9 or 10 inches radius. They are not constructed on principle No. 2. An obstacle, 1¼ inch high, under a wheel 5 feet in diameter, worked by a 9-inch radius crank, is sufficient to reduce any locomotive-power, borne by that wheel to a minimum, on the principle No. 5, see figures 3 and 5. The hills, ruts, and stones, of a common road, are frequently equal to a succession of obstacles 1¼ inch high.

Therefore, locomotive-carriages on plain wheels, as at present constructed, cannot travel over the hills and obstacles of common roads, which was to be proved.

I said the new theory of locomotion would be unfolded, and I trust its leading principles have been. They consist of the scientific and peculiar application and combination of power, leverage, friction, and gravity. The power may be immense; yet, if the friction, gravity, or leverage be wrong, the whole or part of the power will be thrown away, the machine will not go; and if the friction, gravity, and leverage, be scientifically adjusted, there will be no waste of power, but a certain quantity will do the greatest possible work. Further to condense and illustrate this new theory, I will lay down the principles for building two locomotive-carriages, one for an iron rail-road, and another for a common road.

For an iron rail-road with iron wheeled carriages.—Let the quantity of friction between iron and iron be ascertained as before directed, and whatever it is, that is the maximum hold that the wheels can have on the road, and will show the greatest ascent that can possibly be mounted.—If the power is to be applied to one pair of wheels only, then let the whole weight of the carriage be placed in equilibrio, or nearly, on those wheels; this will make the friction the greatest possible, and will bring the centre line of gravity or weight, as near to the fulcrum as possible. If the power is to be applied to two pairs of wheels, then let the weight be adjusted on those wheels in like proportion with the power that is applied to them. Then, if it be wished to move with the least possible power, let that power be applied as near as practicable to the circumference of the wheels bearing the load—which will give the long arm of the lever the greatest extent. No combination of principles but the above, will take so much weight up so steep an elevation, or drag so great a load with so little power. The size of the wheels is not of much importance on rail-roads, which are here considered smooth, except for lessening the axle friction, as there being no casual obstacles on the road, the long or power-arm of the lever will always maintain the same proportion to the short arm, whatever the size of the wheels may be.

I am speaking now of principles, not of building carriages to suit this or that convenience or desire, as to speed, &c.—power and speed will regulate each other.

For a common road, with iron-wheeled carriages.—Let the same general principles be applied as in the rail-road carriage, ascertaining the friction between iron and gravel or stone; but as there are casual obstacles on the road, and when such occur, they suddenly shorten the power-arm of the lever, and lengthen the resisting arm, care must be taken, by having the wheels large enough, that no obstacle can ever reduce the power-arm of the lever to nothing or an inefficient length; and, if the power be applied to two wheels only, which are not made the guiding wheels, some little weight must be laid on those wheels which are made the guiding wheels, to enable them to have hold enough of the ground to steer by, or more weight may be laid on them, if they are not likely to encounter the same obstacles with the power-wheels at the same time: and let it not be forgotten, that the hills of common roads are as subject to casual obstacles as the flats, by which obstacles the ascents are in effect doubled or trebled.

As I have before explained and proved, the principles which will not succeed, and by contraries, the principles that will succeed: I have only to say, that the large Triumph steam-carriage is constructed on the latter principles; and, therefore, will surmount the obstacles and hills of common roads, which was my *third* problem.

The successful application of these principles to practice on common roads, will depend in a considerable degree on the relative lightness of the steam or motive engine, in proportion to its power. I had a 3-horse power steam-engine and carriage made, with all attention practicable to lightness, and when finished, it was 3 tons weight. What can 3 horses do with 3 tons on a common road up hill? But move at a slow pace; and, as I have shown that machinery action, in ordinary cases, is not so powerful as horse action, if the 3-horse engine could not have been forced beyond its calculated strength, the machine, although on true principles, must have stood still.

I propose, excluding the indefinite term "horse power" altogether, and substituting instead, as a scale of power for locomotive power engines, the actual pounds of pressure on the piston or pistons, which are, in fact, the only true measure of the power; I would call an engine a 1000lbs. power-engine, or a 1200lbs., 1500lbs., 200lbs., 10,000lbs. power-engine, according to the actual pressure used upon the pistons. The "little Triumph" has about an 180lbs. power-engine.

The theory of the singular wheel-barrow problem (which is, of itself, almost an epitome of the science and practice of locomotion) is this:—The bar is intended to be, and in theory must be, of such a size and material as that the friction and power of descent may be equal or nearly so, that is a maximum. (Prop. 4).

By standing a little in advance of the axle, the body part of the barrow is brought by the weight of the man to an equilibrium on the axle, which makes the friction between the wheel and the bar the greatest possible, and also brings the centre line of gravity of the whole (man and barrow) close as possible to the fulcrum or bar. The muscular power of the man's arms (or muscular power and weight jointly if so applied) is then exerted on the rim of the wheel, or the longest possible lever, making the whole a maximum as proposed. I must not omit to say, that if the man *throw* his weight backward, he produces some *momentum*, which makes the barrow surmount a greater bar (or one steeper than the power of descent) than it otherwise could do, at what I call a dead lift, and the introduction of this momentum will make the question of the theory a more compound question. Momentum is of astonishing force, and comes greatly in aid of moving carriages, as is exemplified in the running carriages at Liverpool, which can run over a man, but cannot *start* over a marble. Still there is no real permanent power created by this momentum, as is well known, and when part of it is lost, it must be supplied afresh by the first mover, or the machine must remain without it. Several of the positions and assertions in these demonstrations must be considered as only generally, not strictly or invariably true; it would not suit the nature or serve the intention of this short essay, to enter into mathematical niceties, nor do I know, that my experience would at present justify it; I may have stated one line to be parallel with another, when I have been convinced, that if there existed any angle between them it was such as would not materially affect the general truth of the demonstration.

A theory of locomotion is an addition to the stores of science, and its discoverer hopes for the indulgence always shown to those that attempt to do what was never done before. If his essay shall be found defective, it is at least all his own, with the exception of this paragraph; he is not like many other writers, a compiler or transcriber, what he delivers, he has learnt by attention to experiments; and some will be surprised to see, that reduced to principles, which they have used only by accident or imitation.

Some very curious results arise out of a comparison of the effects of horse-power and machine-power in moving carriages, and also some equally curious in investigating the various circumstances under which power may be applied for locomotive purposes, in mechamotive, manumotive, or pedomotive carriages; opening a new and extensive field for scientific calculations, of a nature different to any thing I have seen in books, but at present perhaps more curious than useful; although I believe the day will come when such calculations will occupy the attention of mathematicians, and when locomotion will claim and have a separate cabinet in the temple of science, and be known and treated of by its own defined laws, as is mechanics, pneumatics, and hydraulics.

Yours, &c. SAXULA.

P. S.—As my habits and situation in life render it inconvenient for me to put this theory into practice, farther than exemplifying its truth by insulated experiments, I shall be happy to confer with any one who feels disposed to bring it before the public as a matter of useful operation.

ASCENT OF ELECTRICITY FROM THE SEA.

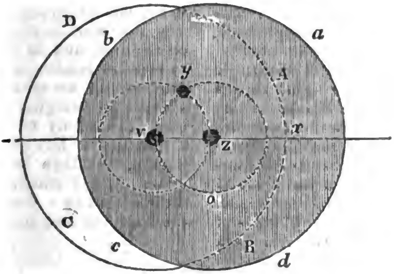
Sir,—I was much gratified on reading the account, given in your 400th Number, by Colonel Macerone, of streams of electricity springing upwards from the depths of the Mediterranean Sea. The communication of Colonel M. is not the less interesting that a similar phenomenon was before observed by Captain Bonnycastle, R. E. in the Gulf of St. Lawrence, and described by him in a paper sent to the Lit. and Hist. Society of Quebec.

At two o'clock, A. M. 7th Sept. 1826, the mate of the vessel in which Captain Bonnycastle was sailing, whose watch it was on deck, suddenly aroused the Captain in great alarm, from an unusual appearance on the lee-bow. The night was star-light, but suddenly the sky became overcast in the direction of the high land of Cornwallis county, and a rapid, instantaneous, and very brilliant light, resembling the Aurora Borealis, shot out of the hitherto gloomy and dark sea, and was so vivid that it lighted every thing distinctly even to the mast-head. The mate having alarmed the master, put the helm down, took in sail, and called all hands up. The light now spread over the whole sea between the two shores; and the waves, which before had been tranquil, began now to be agitated. Captain Bonnycastle describes the scene as that of a blazing sheet of awful and most brilliant light. A long and vivid line of light, superior in brightness to the parts of the sea not immediately near the vessel, showed the base of the high, frowning, and dark land abreast; the sky became lowering and intensely dark. The oldest sailors had never seen any thing of the kind to compare with it, except the Captain, who said he had observed something of the kind in the Trades. Long, tortuous lines of light in a contrary direction to the sea, showed us immense numbers of very large fish darting about as if in consternation at the scene. The sprit-sail yard and mizen-boom were lighted by the reflection, as though gas-lights had been burning immediately under them; and until just before day-break, at four o'clock, the most minute objects in a watch were distinctly visible. Day broke very slowly, and the sun rose of a fiery and threatening aspect. Rain followed; Captain Bonnycastle caused a bucket of this fiery water to be drawn up; it was one mass of light when stirred with the hand, and not in sparkles as usual, but in actual coruscations. A portion of this water kept in an open jug preserved its luminosity for seven nights! On the third night the scintillations in the sea re-appeared, and were rendered beautifully visible by throwing a line overboard, and towing it along astern of the vessel. On this evening the sun went down very singularly, exhibiting in its descent a double sun; and when only a few degrees above the horizon, its spherical figure changed into that of a long cylinder, which reached the horizon. In the night the sea became nearly as luminous as before. On the fifth night the luminous appearance nearly ceased. Captain Bonnycastle is of opinion, that this phenomenon is caused not by living marine animals, but from phosphoric matter evolved from exuviæ and secreted matter of fishes, &c

Yours, &c.

VON EGMONT.

MOVEABLE OR ADJUSTING DOTS.



Sir,—Adjustable cross hairs or dots are indispensable requisites to a Mathematical-instrument maker, and they are made so at present by two or more screws, which screws are sometimes very much in the way of the work. The same adjustment of the dots may be obtained by a more simple contrivance—an eccentric revolving plate.

Suppose ABCD to be a thin circular plate revolving on its centre V, in the direction of the letters, and *abcd*, another similar plate, revolving on its centre *z*, also in the direction of the letters, or the contrary way to the former one. The centre of *abcd* runs in the plate ABCD, at the distance *vz* from its centre, or the same distance that the dot *x* made on *abcd* is from its centre, as shown by the two dotted circles.

To use the instrument, let it be required to place the dot *x* over the point *z* (as seen by a *stationary* microscope) by the rotary motion of the two plates. By the motion of *abcd*, it will carry the dot from *x* to *y*; then, by moving ABCD, you may bring it from *y* to *z*, the place required. By the same means you can place the dot any where within the small circle, *xy v o*.

It is not necessary that the centre of the circle, *abcd*, be made as small as here shown; but *d* would be much steadier if made like a hollow ring, in which case a piece of glass might be inserted in the small circle, *xy vo*, when the lines or dots might be drawn on the under side of the glass; and if the cell, in which the glass is put, is made the proper length, the glass will touch the work when the work and the lines might be seen by the same adjustment of the microscope. The glass on which the lines are drawn must be rather more than *vx* or twice *vz*, and of course the centre likewise; also, it is necessary to mention that the centres should be ground into their sockets.

Yours, &c.

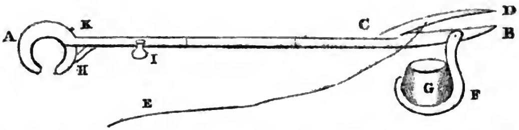
W. ETTRICK.

April 26th, 1831.

N.B.—If the circles are graduated, and the diameter of the circles known (as the tenth part of an inch) the distance *xz* can be found by a table of sines, by taking the difference of their motions. I forgot to say, that the circle ABCD must have a centre more than twice *vx*, that is more than twice as large as the other circle.

W. E.

NEW MECHANICAL FRUIT-GETTER.



CB, CD, are a pair of clippers or blades, turning on a fulcrum; CKC is an arm or long pole, fixed near the fulcrum to the lower blade; the arm KC, may be lengthened or shortened at pleasure, if it consist of two pieces connected by bands or ferrils going round them. I is a handle fixed on the arm, for the purpose of guiding the blades to any part required, or to force them outward or inward. About the middle of one side of the upper blade, is fastened one end of a string E, and a spring at C acts on the upper blade to force it open. F is a hook fixed on the lower blade, and going round the basket G. AH is a hook made of iron, fixed on the arm KC, and heavier than the rest part of the instrument; the hook consists of two parts, one of which, A, is fixed on the arm, the other is moveable round a joint on the arm, and is acted on by a spring at H; this renders the hook capable of grasping all branches strong enough to support its weight. The person who uses it, has only to fix the hook, direct the blades to any part by means of the handle, and then he may take the fruit by pulling the string. When not used, there should be a ferril or hoop put over the blades to keep them closed.

J. G.

SUTTON WASH EMBANKMENT.

"And oceans from their mighty wounds recoil."

This stupendous and useful undertaking—comparatively unknown to the public, yet as beneficial in its results and difficult in its accomplishment as almost any work of national importance—is now almost finished, and will add one more to the many monuments in existence of the scientific skill, unwearying energy, and undaunted enterprise of the people of England.

This embankment is constructed across a dangerous estuary, in the crossing of which many lives, and much property, have been lost. On Thursday, the 5th of May, the noon-tide ceased, and for ever, its flowings over an area including above 15,000 acres!

Properly to comprehend the magnitude of the work, and to appreciate the ability evinced in its execution, the statement of a few facts may be necessary. The bank has to resist for four hours in every twelve the heavy pressure of the German Ocean or North Sea, the length of which is 1400 miles and the circumference about 5000, and which a north-westerly wind brings up in tide-time through the estuary with astonishing violence and rapidity. The length of the cross-bank, from the bridge to the opposite side in Norfolk, is one mile and a half. The time occupied in its construction has been about three years and a half; and the force employed to conquer the mighty deep, 900 men and 260 horses, under the able superintendence of Mr. Roffey. To maintain order and subordination, for so considerable a time, among so numerous a body of rude and uncultivated men, has been in itself a task of no small difficulty.* The bank will be passable for coaches about the end of July, and will then furnish the best line of communication between Norwich and York, Liverpool and Manchester—saving a distance of full 36 miles, and uniting the northern and eastern parts of the kingdom. The road being along a high bank, with a palisade continuous with the bridge, will afford at high-water one of the most pleasing prospects the eye can desire. The bridge is allowed to be unequalled in modern buildings; it is composed of the best British oak, with a moveable centre of cast-iron 52 feet span. The new outfall of the Neue into the ocean, cut through a distance of 8 miles, was the first part of this undertaking, and during two years it employed from 1000 to 1300 excavators; it is one of the finest tideways in Britain, and of sufficient depth to allow a man-of-war to float close to the bridge. During the whole progress of these great works, not one failure of any kind has, I believe, occurred.

The Mechanics' Magazine is so frequently the depository of the records of public works, conspicuous for their utility and magnitude, that I have been induced to furnish the above compressed account from a country paper, in the hope that some one, either employed on the undertaking, or qualified by local situation and knowledge to supply an historical detail of the progress of the work, will favour your Magazine with the particulars of an improvement which seems to be justly regarded as one of the wonders of English art. To Messrs. Jolliffe and Banks, the contractors, no small meed of praise is due for the success which has attended this great undertaking. B.

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APPLICATION OF INCLINED PLANES IN CANALLING.

[We are indebted for the following piece of information to a Number of the New Harmony newspaper, called the *Desseminator*, which has been obligingly forwarded to us by a friend; and into which journal it appears to have been copied from the *Newark* (U. S.) *Sentinel*. The canal alluded to is, we believe, the Morris Canal, which commences at Newark, and extends across the State of New Jersey to Easton, in Pennsylvania, where it joins the Lehigh Canal. It is 100 miles long, and almost completed.—Ed. M. M.]

" *Experiment on the Inclined Plane.*—The invention of inclined planes, and the successful experiments which have been made with them in overcoming great elevations, are but of recent date—more especially so in the United States. As far as their principles are known, and their practical utility tested by actual experiment, they cannot but be regarded as a great improvement. A great deal of expense is saved in constructing canals, and besides the difference of the time of boats in passing from the upper to the lower, and from the lower to the upper levels, where the elevation is great, will render the navigation from one end of the canal to the other, much more expeditious and sure.

" The inclined plane in this place has a rise of 70 feet in a length of 770; but the extreme length of the ways is 1040 feet. The ascent is uniform from the surface of the water in the lower level, to the height of that in the upper, at which point the summit curve commences, and the ways, after rising one foot higher, descend into the water of the upper level. There are two pairs of tracks, on each of which is a car of very strong construction, supported by eight wheels, so arranged that the car may nevertheless pass over the summit, and from one declivity to another with an equal bearing on the eight. The cars are connected with machinery by cable chains, capable of bearing a strain of fifteen tons without alteration, and have actually been proved to that degree.—Upwards of twenty tons are required to break them. The strain put upon them by the operation of the Plane is calculated never to exceed six tons. The moving power is a water wheel of twenty-four feet diameter, which is placed a short distance down the declivity of the plane. In the ordinary condition of the plane, one car stands on the upper level, the other in the lower; and a boat may pass in either direction, or two boats in opposite directions, at the same time. The first part of the operation is to draw the car out of the upper level by a separate action of the water wheel; as soon as it has passed the summit and begins to descend, the machinery goes into action, and then the ascending car begins to move. The motions of the two reciprocate, until the descending car reaches the bottom of the plane, at which time the ascending one goes over the summit, and descends into the upper level by its own gravity, independently of the machinery. The boat, if there be one, is then sent forward with considerable velocity, and leaves the car without any effort on the part of the attendants or boatmen. The whole operrtion is performed with a celerity, even beyond the calculation of the engineer. It was performed about sixty times in the course of Friday and Saturday last, carrying boats variously loaded in twelve cases; and once with a boat ascending and another descending at the same time; the load of the ascending boat being about twenty-one tons. The time of the operation has generally been about eight minutes—some times less than seven—never more than nine. Five operations can with the greatest ease be performed in an hour, allowing large intervals for the entrance and exit of boats, and for other purposes; and as two boats may pass at each operation, the plan will accommodate the arrival and departure of ten boats per hour, with a tonnage of 250 tons; or 6000 tons per diem, which is nearly four times the whole commerce of the New York canal to Albany. The detention of boats will not, according to the experiments, exceed seven minutes, (the remaining time on the plane being compensated by the motion *forward*,) which is only a detention of *one minute* for every ten feet of lift. This is a saving of at least nine-tenths in comparison with locks, and reduces the detention on the voyage from Easton to this place, from twenty-four hours, which it would be if locks were used, to less than two hours and a half. There are now three inclined planes on Professor Douglas's principle, finished, and in operation; the others are in a state of forwardness that warrants the expectation of their being done by the opening of the navigation in the spring. All the masonry, and a large part of the carpenters' work, are already completed, and very little remains to be done except to place the machinery, which can be done without inconvenience in the course of the winter. The experiments upon the plane excited much interest, and called forth repeatedly the warmest plaudits of the spectators."—*Newark Sentinel.*

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* I believe, however, that any praise to be awarded on this head must be confined to the working discipline of the men—for the farmers and neighbouring people have suffered severely during the progress of this undertaking, by the loss of sheep, (one farmer in a year has had 100 stolen) pigs, poultry, &c.

* * *

ALE FROM MANGEL WURZEL.

We are glad to perceive, by a letter in the *Coventry Herald* from Mr. William Lester, of Woodhouse, near Loughborough, that he has carried into successful practice the distillation of ale from mangel wurzel; the process for which was first given to the public in the pages of the Mechanics' Magazine, by our esteemed correspondent, Homo, of Laceby, near Grimsby. Mr. Lester's testimony, as regards both the excellence and cheapness of the beverage, is decisive. We subjoin the material parts of his letter:—

"As the season for sowing mangel wurzel approaches, I beg leave, through the medium of your Paper, to add my mite for the good of my poorer countrymen, who have not the means of brewing their own malt, by endeavouring to show the great importance of cultivating this invaluable root by cottagers, and others, having but a small portion of land at command. From seeing an article in a newspaper in the year 1829, describing how a good beverage might be produced from the mangel wurzel, I have made a number of experiments, and have, at length, completely succeeded. In the article before alluded to it was stated, that a portion of about ten pounds of the root to a gallon would make a good liquor; but with fifteen pounds weight to the gallon, an excellent ale will be produced; the addition of two pounds' weight of treacle to a firkin, will be a great improvement. One-third malt and two-thirds mangel-wurzel liquor, will make capital ale; so that, even in this way, an important saving will be effected.

"*Our* method is first to mash and clean the roots well, take off the top completely, scrape (rather pare) off the outer rind, slice and boil them until soft and pulpy; squeeze the liquor from the pulp as much as possible, and then boil it again with about six ounces of hops to nine gallons, and work with yeast in the usual way. Thus a cottager, by boiling his pot over his winter fire of a night, and using the root as we have described, might seldom be without a refreshing beverage even the greatest part of the year, for the roots may be kept in a cool place, in a proper state for use, during most of the winter. The leaves, stripped from the plant in August and September, are valuable for the cow or pig, not retarding its growth in the least; and the roots boiled and mashed in the liquor, and either milk or a small quantity of meal added, will feed the pig at a trifling expense. The culture of this invaluable root is very simple. Let the single seeds be put on well-manured ridges, eighteen inches apart, and six or eight inches between the plant; hoeing down, and keeping clean from weeds, will be all that is necessary."

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THE DEAD SEA.

A multitude of unfounded reports have long been in circulation, and have gained admittance into many valuable works, respecting the dreariness and insalubrity of the lake Asphaltites, and of the region of country around it. It has been affirmed, that fish could not live in its waters; that no substance would sink in them; that every kind of matter thrown into the lake, however heavy, would instantly be pressed to its surface; that, owing to the destructive exhalations which perpetually proceed from the water, every bird that attempted to fly over it fell lifeless on its surface; that dismal sounds issue from it, like the stifled clamours of the people who were engulphed in its flood; and that a very beautiful fruit grows on its margin, which is no sooner touched than it becomes "dust and bitter ashes." These and a thousand other wonderful tales of a similar character, modern travellers have discovered to be entirely fictitious.

"About midnight," says Chateaubriand, "I heard a noise upon the lake, which the Bethlehemites told me proceeded from *legions* of small fish, which come and leap about upon the shore." Dr. Clarke remarks, "that the waters of this lake, instead of proving destructive of animal life, swarm with myriads of fishes; that shells abound on its shores, and that certain birds, instead of falling victims to its exhalations, make it their peculiar resort."

"We saw a great number of birds," says Mr. Fisk, "flying about its shores, and I once observed three or four flying over the water."

"The water of the Dead Sea," adds this excellent missionary, "looks remarkably clear and pure; but, on taking it into my mouth, I found it nauseous and bitter, I think, beyond any thing I ever tasted."

The waters of this lake are, indeed, heavier than those of any other lake or sea on the face of our planet. Their specific gravity is 1·211, distilled water being 1·000. They are almost completely saturated with saline matter. A bottle of this water was analyzed by Dr. Marcet, of London, in 1807.

In 100 grains of it he found

	Grains.
Muriate of lime, . . .	3·920
Muriate of magnesia .	10·246
Muriate of soda, . . .	10·360
Sulphate of lime, . .	·054
	24·580

In 100 grains of the water there are 24½ grains of salt. A person can swim more easily in the Dead Sea than in fresh water, or in the ocean. A substance which would sink in ordinary salt water, will, consequently, be urged to the surface in this sea. Strabo asserts, "that men could not dive in this water;" which is not strictly true, and "that going into it, they would not sink lower than the navel." This is probably correct. Pococke, who bathed in it, affirms, "that he could lie on its surface, motionless, and in any attitude, without danger of sinking." This is no exaggeration. Most people can do the same, even on fresh water, provided they do not allow the gravity of their bodies to be increased by swallowing the water.—*Professor Hall.*

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BRIEF NOTICES OF NEW PATENTS SPECIFIED IN 1831.

(Continued from p. 93, vol. 15.)

PURIFICATION OF GAS, *J. Down, Leicester.* — The gas is made to pass through charcoal in a state of ignition, instead of lime-water. A greater quantity of gas is stated to be thus obtained. Purification by fire has been tried before —by passing the gas through red-hot tubes, and through red-hot iron filings: but this objection has been always found to prevail against the process—that it makes the gas *too* pure for the high illuminating purposes for which it is required. May not this also be the case in the present instance? —*Date of Pat. August* 5, 1830; *of Spec. February* 5, 1831.

Lock-Break-off and Trigger for Fowling-Pieces, *B. Redfern, Birmingham.*—The trigger, on being pulled, pushes forward a guard-cap, that covers a firing-bolt, on pressing which by the thumb, the piece is discharged. By this duplication of the ordinary operation of firing, it is expected that the risk of accidental discharges will be almost entirely obviated; and there can be no question that to all such steady-going sportsmen as prefer one shot to two—so that it is only attended with perfect safety (to the enemy as well as themselves)—this new gun will be a great acquisition.—*Date of Pat. Dec.* 17, 1830; *of Spec. Feb.* 14, 1831.

Sizing-Paper, *M. Towgood, Dartford, and L. Smith, Paternoster-row, London.* —The size is to be laid on the surfaces of two pressure-rollers, and the paper passed between these rollers; by which means it will be more effectually incorporated with the fabric than by the usual process. Obviously a great improvement.—*Date of Pat. Aug.* 18, 1830; *of Spec. Feb.* 18, 1831.

Railway-Wheel, *William Losh, Benton House, Northumberland.*—An improvement on the wheel, patented by the same gentleman in conjunction with Mr. Stephenson, and described in our review of Mr. Wood's book, p. 174. The felloe is in as many pieces as there are spokes; and each spoke, with the next adjoining felloe, is made of one piece of iron. The spokes are dovetailed as before, at one end only—that next the nave; at the other end, where the felloe commences, there is a crank-bend, which permits each segment of the felloe to overlap its neighbour; and through the overlapping parts there are strong screws to keep the whole firmly together.—*Date of Pat. Aug.* 31, 1830; *of Spec. Feb.* 28, 1831.

Fountain Cock, *Wm. Cook, Red Cross-square, London.* — This fountain cock is a substitute for the ordinary ball cock; it has two passages of equal areas, one for the ingress, and the other for the egress of water—which open and close at the same time; so that supposing such a cock to be placed in connection with two vessels, one containing hot and the other cold water, for every portion of the hot fluid that is drawn off, there will be precisely an equal quantity of cold supplied.—*Date of Pat., Sept.* 7, 1830; *of Spec. March* 7, 1831.

Improved Skate, *John and George Rodgers, Sheffield.*—An elastic sole of steel is proposed to be substituted for the wooden sole or frame, into which the skate irons are usually fixed.—*Date of Pat., Jan.* 18, 1830; *of Spec. March* 18, 1831.

Improvements in Anchors, *Richard Perring, Exmouth.*—1. The lower end of the shank is to be separated into two parts, turned in opposite directions. 2. To the shank, at the point of biforcation, there is to be welded a cross piece of iron, in the manner of a truss, to secure it from fracture. And 3. The anchor is to be increased in its dimensions, in the direction of the fluke arms, which is the natural direction of the strain, and proportionally reduced in other parts.—*Date of Pat., October* 6, 1830; *of Spec., April* 6, 1830.

(To be continued.)

FINE SCARLET PIGMENT FOR THE PALLET.

While prosecuting some experiments on the pigments employed by artists, I prepared a quantity of the biiodide of mercury, and gave it to Mr. R. Peale, requesting him to make some experiments on its working properties and permanency. This distinguished artist obligingly commenced them, but they were not finished at the time he left this country. He found that it readily mixed with oil; combined with other colours, it gave delicate and beautiful shades; and exposed for weeks to the direct rays of a midsummer sun, it remained unchanged. These properties induce me to recommend it as an addition to the number of pigments among which the artist can make a choice.

An economical process for preparing this salt consists in boiling a mixture of 125 parts of iodine, and 250 parts of clean, fine iron filings, with 1000 parts of rain-water in an oil-flask. When the brown colour of the liquid is succeeded by a light green, the clear fluid is decanted and the residue washed with warm water; the washings being added to the green solution, 272 parts of corrosive sublimate, dissolved in 2000 parts of warm water, are then added to the former liquor, and the resulting precipitate is afterwards washed and collected.

This salt, either in crystals or in powder, presents two distinct and beautiful colours. If the precipitate, obtained as above, be heated in a small subliming apparatus, or in a glass tube, it melts and sublimes copiously, and the vapour is condensed in large transparent rhombic tables of a fine sulphur yellow colour. These crystals are permanent in the air and unaltered by the direct solar rays; but the slightest friction, or the contact of a fine point, is sufficient to alter their interior arrangement. The point of contact instantly becomes of *a rich scarlet*, and the same colour spreads over the whole surface if a single crystal, and extends to the most remote angle, if a group of crystals be the subject of experiment. This change of colour is accompanied by a sensible mechanical motion, so that a small heap of the crystals appear as if animated. An ordinary electroscope does not indicate the developement of any electricity, nor is there any considerable elevation of temperature during the change.

By gently warming the crystals, supported on paper over the flame of a lamp, the original yellow-coloured salt is obtained, and the same experiments may be often repeated; affording an elegant illustration of the connexion between colours and the mechanical structure of bodies. Transparent, but minute rhombic prisms of this salt, may be obtained by allowing a hot solution of it, in a solution of corrosive sublimate, to cool very gradually.—A. A. HAYES; *American Journal of Science.*

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SIDEROSCOPE.

An instrument has been invented in France, to which the above name has been given, provisionally from the extreme facility and delicacy with which it indicates the smallest portion of iron in any substance, mineral, vegetable, or animal.

It consists, briefly of a small straw, nine inches long, through one end of which pass at right angles, two fine sewing needles, sixteen lines in length, both strongly magnetised, weighing only one grain. They are inserted in contrary directions. Through the other end passes a single sewing needle, of the same length, weighing a grain and a half, magnetised in the same manner. This instrument is suspended inside of a glass case, by a single untwisted fibre of raw silk, twelve inches long; substances to be examined, are introduced into the case, by a lateral opening. The whole instrument weighs but four grains, and the utmost care is observed to exclude from the frame or table of wood which supports it, the smallest particle of iron, and to avoid the disturbing effects of a current of air, and even of the breath. The substances to be presented for trial are pasted to a small strip of card or pasteboard, to avoid the heat of the hand or fingers.

Almost every piece of money, French or foreign, ancient or modern, gold, silver, or copper, but especially the silver coins of Italy, attracts the sideroscope with greater or less activity; it is the same with all substances, mineral, vegetable, or animal, which contain the least atom of iron, nickel or cobalt. Platina exercises a decided action, notwithstanding all the chemical operations necessary to bring it to a soft state.

Small masses of any of the following substances, weighing at most, eight or ten grains, affect this delicate instrument. All kinds of ashes, compacted by a little gum water; blood simply dried or swelled; chocolate; bottle glass; tourmalines, green and black, not rubbed or warmed; granite; rhomboidal quartz; yellow topaz; green talc; sulphate of iron; all volcanic products; all metals not chemically pure; brass pins, even the finest used by entomologists; various galenas, and other minerals; all ærolites; burnt hoofs, and horns of cattle, &c.

The most surrprising effect of the Sideroscope, is the *repulsion* of the needle by bismuth and antimony.

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MINOR CORRESPONDENCE.

Steam-Coaches.—Sir, The reading of Mr. Herapath's letter, p. 123, of the present volume of your admirable work, would lead one to suppose that Mr. Gurney is the only person who has made any progress with steam-carriages. Now, this is very far from being the case; and whatever may be the comparative merits of any of the parties engaged in this difficult undertaking, time only can decide. But, in the mean time, let it be fairly understood, that without ostentation, and in the modesty of silence, there has been another, long and ardently engaged, who hopes to produce a result that may ultimately surprise even your correspondent Saxula. I agree with this gentleman, that it is unworthy trifling in such a cause to amuse the public about turning, and backing, and stopping—contrivances to be found for years past in every steam-boat—and at the same time to avoid the main points; viz., *following up a journey over gravel and hills, and taking the roads good and bad as they are.* These are the points to try the *breadth* of a steam-carriage. Running round the Regent's Park, and over such roads as that between Cheltenham and Gloucester, may do for an exhibition, as it has long done; but it is no proof whatever that any considerable progress has been made by Mr. Gurney. Credit is due to him for perseverance; but considering the time, the opportunities, and the means he has had at his command, quite enough has been said about his success. Twelve months more will, I am persuaded, bring matters a little round, and place the candidates for this great honour in their just position. Hitherto, the competition has been distinguished on one side, by great pretension, and on the other, by a steady pursuit in silence. Nevertheless, to have fair play, there must be a previous clearing of the stage—This is the aim of A LOOKER-ON.—*London, May* 12, 1831.

Metallic Chimneys.—Sir,—It is with much pleasure I observe the introduction of metallic chimneys on the plan of Mr. Smith. I apprehend they will diminish greatly, not only the number of smoky houses, but of destructive conflagrations. But I think there would be more advantage gained, were every chimney to be made of less dimensions half way down from the top than at the lower part. I would also suggest having an opening of a triangular form, at the back of the grate, sufficient to admit the escape of the dust from the fire; by which means the room will be kept much cleaner than it can otherwise be.—I am, &c., ISAAC DUDLEY.—[Mr. Smith may consider Mr. Dudley's opinion a feather in his cap. Mr. D. is the author of a pamphlet, called "The Tocsin," which has been more than once noticed with approbation in our pages, for the sound practical views which it contains on matters of domestic and civic economy.—ED. M. M.]

Slitting and Polishing Stones.—A correspondent, who signs himself "Lapis," at the 352d page of your Magazine, vol. 3, asked for the best method of *dividing* and *polishing* calcareous and silicious stones. If the answers to his query have satisfied him, I cannot say, they have me, as I do not consider them sufficiently clear for the *uninitiated.* "E," vol. 1, p. 447, recommends rubbing the surfaces with the emeries, rough and fine, on a leaden plate, and so on through the *Scotch grits,* &c. &c. What the *Scotch grits* may be, I know not; I only know, that the former part of the operation is extremely tedious and laborious, even for small pebbles, if rubbed from the circumference to the centre. Another correspondent, J. M. N., page 159, vol. 4, gives a drawing of a mill as sold by Mr. Mawe, for six or eight guineas! Surely it cannot require machinery of this expensive description to polish a small stone? But J. M. N. carefully avoids giving any information as to the composition of the various "*mills*" which are to be "screwed on." They are, probably, to be made of "*Scotch grit!*" I have tried the plan for *slitting* with the iron plate, but cannot persuade myself that it is the method used by lapidaries, having seen them divide a stone in a tenth of the time that I can do. This is probably owing to my inexperience; and I shall be much obliged to any of your correspondents who will favour me, through your medium, with a complete account of the best and least laborious method of *slitting* and *polishing* calcareous and silicious stones merely for ornamental specimens. I may as well state, that I have a good turning-lathe, which, I presume, will be of some utility in the process.—Yours, &c. MARMOR, *Dudley, April* 18, 1831.

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The new Steam-Carriage now erecting by Mr. J. Green, coachmaker, in Boston, drew a large number of inspectors during the fair, and the principal part of the scientific visitors were much pleased with the simplicity of the steam apparatus, &c., particularly the new method *Mr. G. has invented* for supplying the steam generator with water, which is effected without the aid of the force pump, or any other pressure: this is a great saving of power, as the engine has nothing to do with getting in the water to feed the boiler. On the new principle, water falls into the boiler as freely as rain from the clouds, although the steam should be raised to 10,000lb. pressure to the inch. We understand the inventor intends to have his steam-carriage in use on the regular coach roads by next September; the first trip is intended to be from Boston to Lincoln, and thence to Doncaster, &c. To remove the fear of the boiler's exploding, its strength will be proved (by a committee) to be equal to carrying 160lb. to the inch on the safety valve; and when in use, it will never carry more than 60lb. to the inch on the valve.—*Lincoln Mercury.*

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LIST OF NEW PATENTS GRANTED FROM THE 20TH OF APRIL TO THE 20TH OF MAY, 1831.

William Dixon, of Walsall, Staffordshire, brass-cock founder, for an improvement or improvements on the cock or tap, applicable to fluids, liquids, and gases, communicated to him by a person residing abroad. Six months, April 21, 1831.

Joshua Taylor Beale, of Church-lane, Whitechapel, engineer, for an improvement in certain apparatus for separating a portion of aqueous vapour from the vapour of alcohol, in the process of distilling and rectifying spirituous liquors. Six months, April 30, 1831.

George Stephenson, of Liverpool, civil engineer, for improvements in the mode of constructing wheels for railway-carriages. Four months, April 30, 1831.

William Gutteridge, Clerkenwell, Middlesex, civil engineer, for certain improvements in apparatus for distilling, and other purposes. Six months, May 18, 1831.

Robert Burton, cooper, of Battersea-fields, Esq., for an improvement or improvements on a cock or tap, applicable to fluids, liquids, and gases, and for applying the said improvement or improvements to other useful purposes. Six months, May 18, 1831.

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INTERIM NOTICES.

We shall be glad to receive an Account of the Steam Experiments, referred to by our esteemed correspondent W. E.

There are some parts of Mr. Nutt's letter, the meaning of which we cannot make out. We wish he would write to us again, and be a little more particular and explanatory.

Want of space obliges us to defer the conclusion of our review of Wood on Railways, till next week.

Communications received from Mr. Scrymgeour—Mr. Busby—S. W. (of Belper)—Hezron—G. M.—Un Abonné—Mr. Henderson, (whose previous letter came also to hand)—Gilbert—I. F.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

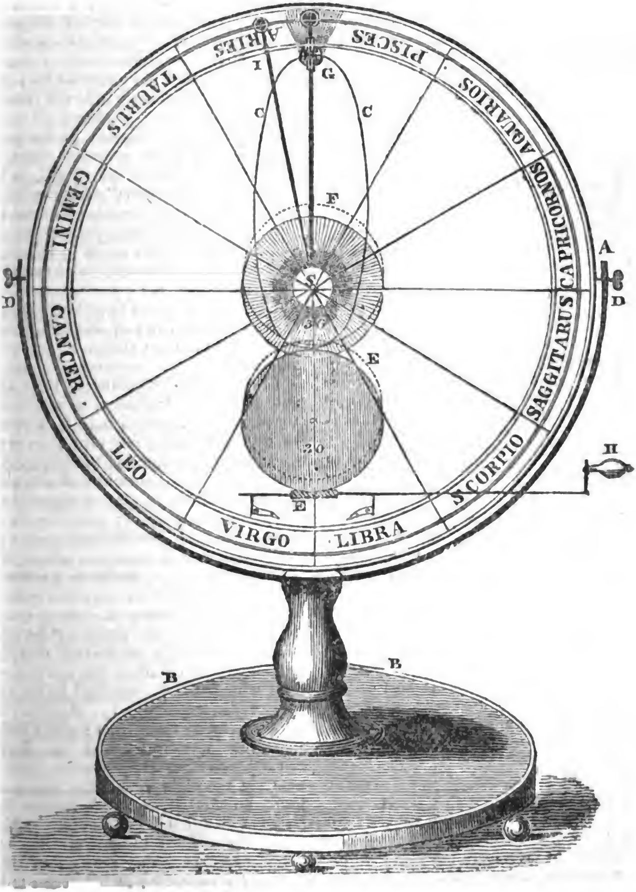
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 408.] SATURDAY, JUNE 4, 1831. [Price 3*d*.

HENDERSON'S COMETARIUM.



HENDERSON'S COMETARIUM.

Sir,—The accompanying drawing exhibits a front-view of an apparatus which I invented some time ago to illustrate the motion of a comet round the sun. The better to enable your readers to comprehend the manner of its construction and use, I have compiled for their information the following preliminary sketch of the progress of our knowledge of this class of heavenly bodies.

In the earlier ages, comets were regarded as special messengers, sent by the Deity to warn his creatures of some coming event of direful import, as war, famine, pestilence, rebellion, revolution; and as mankind were never long without some such memorable visitation, there never appeared a comet to which it was not easy to assign its particular prophetic mission. As the world advanced in knowledge, this irrational notion of the purposes which comets are intended to serve in the economy of nature, gradually fell into disrepute. But though we have for a long time ceased to contemplate them through the false medium of superstition, it must be confessed that our acquaintance with their real nature and functions is still extremely imperfect. We know little of the periods of their motions; even their number we have not counted; and all that science has yet told us of their ends and uses is mere conjecture.

From two observed facts, we seem to be justified in inferring that they are dense bodies, and reflect the rays of the sun. The first is, the steadiness with which they shine, giving forth a light which has more the appearance of being reflected than emitted. The second is, that some of them have been observed to exhibit phases—that of the year 1744, for example, one-half only of which is said to have been illuminated.

Comets are generally observed to consist of an internal or central part called the *nucleus*, which is surrounded by something like an accumulation of vapours or an atmosphere, which, from its resemblance to flowing hair, has received the name of *coma*—whence the generic appellation of *comets*. The flow of the *coma* is always in a direction contrary to the path of the comet, with a considerable degree of curvature towards the opposite part of the heavens. So rare is the matter of which this *coma*, or tail as it is more popularly called, consists, that the stars have been often observed *through it*. Its length appears smaller or greater according to the position in which an observer on the earth is situated in regard to it. Sir Isaac Newton, who was the first among modern astronomers to investigate successfully the nature of comets, defines them to be "*solid* and *opaque* bodies;' and he holds that they must necessarily be so, because they revolve in a much more elliptical orbit than any of the planets round the sun, and have consequently to support great extremes both of heat and cold. But that they cannot be *very* solid may be reasonably inferred from this, that their presence produces no sensible effect when they happen to be in conjunction, or near to each other. A comet is said, in the year 1454, to have "eclipsed the moon;" but the expression is generally considered to have been figuratively employed on the occasion. To eclipse the moon in brightness, and to eclipse it literally and astronomically speaking, are evidently two different things. Comets have been observed to pass the satellites of Jupiter, without producing the least visible effect on their motions.

Comets, like the planets, have a real and an apparent motion; a real motion through space, which may be ascertained by their passing different stars in succession—and an apparent motion, caused by the diurnal revolution of our globe. The real motion is distinguished by an irregularity altogether peculiar to this class of bodies. Sometimes comets proceed from east to west—at others, from west to east; nay, disdaining quite the limits of the zodiac, they traverse the heavens in all directions, even in courses perpendicular to the plane of the ecliptic. Tyho Brahe conceived that they described a circle *above* the sun (an opinion which may be ascribed to his anti-Copernican principles); Kepler, that they moved in right lines; and Cassini, that they revolved round the Earth: but it has now been long known that they actually circulate round the Sun; and there is every reason to presume that they are obedient to the same laws which retain the planets in their orbits. The parabolic curve is very nearly that which all comets describe; and it seems to be entirely owing to their being of that form, and to the Sun's being situated in the lower foci of their orbits, that they are for so short a time visible; it being only while they go through the perihelion portion of their orbits (or that part nearest to the sun), and when they are at their greatest velocity, that they are visible on the Earth. The illustration of this fact is what I have had particularly in view by the construction of my cometarium, which I may now proceed to describe.

AA represents a circular frame of wood, into which there fits exactly a glass plate, one foot in diameter. This plate is stained blue, and upon it there is laid down, in a gold or yellow colour, the signs of the zodiac, the positions of a few of the stars of the first and second magnitude, and the comet's ecliptic orbit. Exterior to this plate are two thirty-teeth wheels, which take into each other, and work in unison. To the upper of these wheels there is attached an index I, with a miniature Sun at its extremity which moves in the circle of the zodiacal signs. To the *under* wheel there is made fast an eccentric wheel E, which takes into another eccentric wheel F, of the same number of teeth, (say 30) which has a hollow axis, that turns freely on the solar axis of the wheel that carries the index I. (The eccentric wheels E and F are represented by the dotted lines in the figure.) The two lower wheels being made fast to each other, have one regular motion common to both; but the eccentric one (E) acting on the other eccentric wheel F, which turns loose on its axis, the motions of the latter are at all times very irregular, being either faster or slower, according to the degree of deviation from the common centre of motion. On the hollow axis of this eccentric wheel (F) is placed the cometary index, consisting of a slender steel wire, not round, but square. In the upper part of this index, slides, with ease, a brass bar with a square perforation, and to the under part of it there is attached a small brass pulley, having a horizontal motion, so that it can suit itself to the form of the orbit of the comet which is to be traversed. To the top of this sliding bar, there is made fast a small piece of stained glass to represent a comet. The wire on which this is fixed must be prolonged nearly six inches from the frame work, as also that of the other axle, that they may be flush with the inside of the glass plate. Two things now become necessary to be noticed; first, that the frame with the wheel-work must be placed behind, nearly six inches from the inner surface of the glass; second, that the ellipsis, or comet's orbit, represented in the drawing, has a corresponding one of brass, on which the before-mentioned brass pulley runs, and that the two ellipses must be exactly the same, and placed right against each other. To the frame-work, which, as already noticed, is about six inches behind the front frame, is affixed a small lamp, which lightens up the whole apparatus. A broad circular rim of tin, seven inches or so in breadth, is now attached to the back of the glass plate, by means of the frame screws D D, (which also serve to tighten the frame containing the glass).

The whole apparatus being now in readiness with the indexes in the positions represented in the drawing, suppose we take hold of the handle (which has on its axis an endless screw that turns the wheel, having the regular motion), and make it revolve. In this situation the comet will have a very slow motion, being then in the aphelion part of its orbit; and the equable moving index, I, will gain considerably till it advances to the sign Leo. The comet will now have nearly attained its perihelion and swiftest motion, (showing the Sun's attractive power), and it will fly to the sign Scorpio in the line that the index, I, advances above half a sign. When the comet is in or near its conjugate diameter, the motion will average with that of the equal motion on the Sun index, and the two indexes will again meet as at their first outset, namely, in the first degree of Aries; the comet moving all the while in the ellipsis, and the equable moving body in the circle, acknowledging the Sun as their centre of motion (see Ferguson's Astronomy, for more on this head). By this means it may be readily demonstrated, that comets in their circuit round the Sun describe equal portions of its orbit in equal times. Hence, when the period of the revolution of any comet is known, the greater axis of its orbit, or its greatest distance from the Sun, is easily found by the following rule:—The square of the time of the revolution of any one planet is to the square of the revolution the larger pair of wheels alone; in the old engines each of the cylinders worked a separate pair of wheels. We have before adverted to the loss of power inseparable from so unequal a distribution of the strain and pressure (p. 174 No. 405), and not need now enlarge upon it. Mr. Stephenson himself has, at length, found this out, and no longer constructs his engines on the plan of the Rocket. Mr. Wood is probably by this time also of the same mind; but, unfortunately for his consistency, he has devoted some pages of his book to an elaborate demonstration that the mode of construction followed in the Rocket is one of the best that could be devised! However, there are such things as third editions of even very imperfect books—and Mr. Wood has already retracted worse errors than this.

In the experiments with the Rocket, to which we have just been adverting, the engine, in proceeding from the starting-post, drew the load *after* it; but in returning it pushed the load *before* it. A difference of speed appears to have been thus occasioned which is deserving of notice. “ The eastward (outgoing) trips were invariably performed in less time than those in the opposite direction ;” and “ as the road was said to be perfectly level, we can only attribute the difference of effect to the disadvantageous action of pushing the carriages instead of driving them.”—P. 373.

The trial made of the Sans Pareil of Mr. Hackworth was, as the reader will recollect, interrupted by an accident; but, so far as it went, it furnished the following results:—

		H.	M.	S.			
“ At full speed....	10½ miles in	0	50	49	equal to	$12\frac{4}{10}$	miles per hour
	12 miles in	0	40	27		$15\frac{1}{10}$	
Ends of stage......	1⅞ miles in	0	19	47	equal to	$5\frac{7}{10}$	miles per hour.
	2 miles in	0	20	8		6	

Maximum velocity (in one trip) 16½ miles per hour.
Minimum do. do. 12½ do.

“ The greatest velocity attained being in the 5th trip, going east, the 1½ miles being traversed in 3′ 59″. which is at the rate of 22⅓ miles per hour.

“ The whole distance traversed by the engine was 27½ miles ; and the consumption of coke was 1269lbs.

Which is { including the engine and tender 2·41lbs. } per ton
{ exclusive of do 4·2 } per mile.

“ The quantity of water used was 274 imperial gallons, or 43·84 cubic feet ; and, consequently, the consumption of coke was 28·8lbs. for each cubic foot of water evaporated.”—P. 376.

There is enough contained in these results to show that the Sans Pareil could in no event have had any chance of the prize. It appears to have consumed not only a great deal more fuel than the Rocket, but more even than the worst of the old engines. That it should have exceeded the Rocket in this respect is not surprising, for its boiler was on the old double-tube plan, with only about 47·12 square inches of exposed surface ; while the tubular surface exposed, in the case of the Rocket, amounted to about five times that quantity: but that it should be so much more wasteful than other double-tube engines, is a result which few will have anticipated. Mr. Wood ascribes their disparity to the employment of an excessive draught, and apparently with good reason :—

“ On the introduction of these (the tubular) engines, it was necessary to resort to the application of the waste steam thrown upwards into the chimney to create a sufficient current of air through the fire ; which was afterwards laid aside, or only partially used, when only slow rates of speed were required. Mr. Hackworth had, it appears, in his engine resorted to the use of this in a more forcible manner than before used, throwing it up as a jet ; and which, when the engine moved at a rapid rate, and the steam thereby almost constantly issuing from the pipe, had a most powerful effect. This, though effecting the object for which it was intended, being carried too far, partly in consequence of the rapid speed at which the engine was made to travel, was productive of another evil, which though operating fatally so far as regarded that particular experiment, was capable of easy remedy. The consequence was, that when the engine began to travel at the rate of 12 or 15 miles an hour, the draught was so great that it actually threw the cinders out of the chimney with considerable force, producing a consumption of fuel enormously great, so much so, that the consumption was, at least, 692lbs. per hour."—P. 390.

Of the Novelty, and its performances, Mr. Wood speaks in very liberal and handsome terms. We are not sure that he perfectly comprehends the principle of its action, but he shows no want of inclination to do it justice to the extent of his knowledge. He admits, that "theoretically considered, this mode of generating steam (Messrs. Braithwaite and Ericsson's) is more economical, in point of fuel, than in engines the combustion of the fire of which is kept up by the rarefaction of the chimney;" regrets that "the experiment with the Novelty could not be continued sufficiently long to ascertain the power of raising steam by this method;" and shows a laudable anxiety to demonstrate that the failure of the Novelty at the Liverpool Competition "arose from no defect in the principle, but only in the construction of the engine."

(To be concluded in our next.)

◆

HYDRAULICS—REPLY OF THE AUTHOR OF THE "VOICE OF REASON" TO MR. CROOKENDEN.

Sir,—Your correspondent, Mr. Crookenden, (No. 399, p. 71) has thought proper to address "a few reasonable considerations to the author of the 'Voice of Reason.'" Probably Mr. C. has done this from interested motives; with a view, not to the benefit of the inventor, but for the general benefit of millwrights, pump-makers, bread-eaters, and all the profitable mechanical uses to which the machinery in question might be most economically and universally applied.

Mr. C., in his first paragraph, states, "that he cannot but express his conviction, that in the formation of this theory the Editor of the 'Voice of Reason' is labouring under a very considerable mistake." Whatever that mistake may be, Mr. C. has not clearly pointed it out, which, in order to its rectification or refutation, he ought pointedly to have done. He is informed, as was Mr. Baddeley, that to *point* out errors, and to have them corrected, is one grand source of all *improvement*. It is scientifically impossible satisfactorily to reply to mere vague insinuations; but one thing appears certain, from a view of the different letters of my opponents, that it is *they* who "labour under very considerable mistakes" as to the theory in question; for, with a *perversity* which can only be accounted for either from downright *negligence* or incapacity of *perception*, they continue calculating for an *overshot*-wheel, when that in question is all along an *undershot* one.[*] The same also appears evident, from the passage in which Mr. C. says, "Consequently the radius of the wheel must be 16 feet, giving the whole diameter 32 feet, (exactly the height of the pump) and then what becomes of the intermediate machinery of the three water-wheels, &c." Why, Sir, the water-wheel, it is again repeated, is an *undershot*, and might be of *any height*, without at all interfering with "the machinery of the three water-wheels of the mill." Neither would it be necessary that the cranks and levers for the operation of the pumps should be of "equal radius with the wheel."

"The beam of a pair of scales." Indeed! this discovers the other "mistake under which (some) appear to be labouring." They evidently calculate that the whole weight of a body of water 32 feet in altitude is to be *lifted up* to that acquired height *solely* by the *mechanical power of leverage!* Why, Sir, had the pumps been endless *chain-pumps*, then such *mechanical* calculations might have availed; but our theory embraces, not merely *simple mechanical powers*, but also pneumatics and hydrostatics, on which the principles upon which we reason must be considered as depending upon direct experiments, adapted to the particular cases, rather than upon the general principles of *equilibrium* and *motion*, as applied to *mechanics*. The Editor of the "Voice of Reason" was aware that the common pump was a very imperfect hydraulic; and to obviate the objection to it, he endeavoured, for his own *solitary* winter evening's recreation, to construct some pumps of a more efficient description; two were with double action, each keeping up a constant stream from two spouts, falling into one trough; and a third had a different mode of exhaustion. From his experiments he felt assured, that water might be raised by more perfect exhaustion to a greater height than 34 or even 50 feet, without any *mechanical power* whatever, either to *lift* the water or *support* it. This may be considered a digression from the subject, but it is intended to overthrow the idea of the supposed necessity for *lifting* the *whole* column of water, as if in and by a cylindrical bucket 32 feet in length, *solely* through the medium of the *mechanical power of leverage*. Now, if by the aid of more perfect hydraulic machines than the chain-pump, &c., we can set this *lifting* wholly or partially aside, the "theory" will no longer resolve itself into the following "absurdity." Can the ascending-half of the circumference of an *overshot* water-wheel *lift up*, at the *same time*, as much water as *descended* by the other half of its circumference, to say nothing of the momentum of the descending fluid? Such a question as this, if not self-evident, might have been more scientifically settled, without "wasting" two whole pages, one of "good engraving," and another of "good type" (see No. 399, p. 72, 3.)

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[*] See Franklin, No. 390, and Trebor Valentine's "absurd" calculation, No. 399, p. 72. Mr. Valentine talks of freeing the pages of the Mechanics' Magazine from absurdities. Mr. Valentine had better *first* look to *his own*, of which notice has been already taken (see No. 401, p. 101.) It is one thing to *pronounce* an "absurdity," but another to *prove* it. Can Mr. V. do this? Till he has—*taceat*—nor presume so hastily, and so *unlike* a philosopher, or *mathematician*, to pronounce "*quod est absurdum*" *before demonstration!*

The "theory," and calculation for an *undershot* wheel, would be as follows: Whatever the dimensions of the wheel, the velocity of the constant stream of water flowing from the lower orifice of the cistern, must be at *least* sufficient to give motion to the wheel, as soon as it impinges upon it—according to its velocity. In what time, then, will the wheel perform one revolution; and what quantity of water would be discharged from the cistern in that time?

Having calculated this, the next question would be—Can this water be replaced by means of hydraulic machinery worked by the wheel? It can. If it can be by *any means* replaced, as it is confidently expected it can by various means, and particularly by improved pumps, which the Ed. V. R. has invented, and for which a patent may be required, it will be sufficient to perpetuate the motion. And, in case any given *increase* of *power*, or force of water should be required, it might be *uniformly* obtained, by adding to the *depth* and capacity of the cistern—aided at the same time by the waste water. With respect to the model and its performance, it is acknowledged that with the *common* pump, it was not perfect; which must be the case with all models constructed upon a small scale, and at *little* expense; but still it afforded sufficient demonstration, that upon a suitable scale, and with a proper mechanical construction, it would succeed. The "*weight*" of water was found to be no obstacle; it was the *friction* or *rubbing* of the moveable suckers against the interior surface of the cylinders, which was the great difficulty to be contended with. This obstacle being removed (as by the *improved* hydraulic above named), the water will be most tractable, and ever ready to flow upwards to the height of 32 feet in *any required quantity*, and without troubling the *mechanical* movement with *its weight*.

Mr. Crookenden is referred to his 4th paragraph, in which he states, that "a constant supply is only a succession of parts, which do not push each other." Do *not* push each other! What, not in a vessel? If you "push" or press the upper particles, that pressure will be *readily* transmitted to the lower. In a cistern full of water, the further any particle is from the surface, the greater will be the pressure upon it. And again, Mr. C. says, "whether a portion of the water be suffered to gush out of an aperture at the bottom, or the whole be allowed to fall over the tumbling bay at the top of the cistern, no real advantage will be obtained." Why, Sir! There is all this "advantage" in the water flowing from the lower orifice of the vessel—that its velocity at the orifice is communicated by the *whole pressure* of the surrounding fluid in the cistern—a constant quantity; whereas, if the same fell over freely at the top, it would only descend by the continued acceleration of a slender column of succeeding particles in the direction of gravity. To accord with the breadth of the water-wheel, the aperture at the bottom of the cistern needed not to have been, as the engraver has erroneously represented it, a small round hole, nearly half way up the cistern.

The foregoing observations being sufficient to answer all Mr. Crookenden's "reasonable considerations," I need, in this matter, trespass no further on your valuable "space;" and am, Sir,

Yours, &c.

Ed. Vocis Rationis.

May 9, 1831.

P.S.—Ed. V. R. would have answered Mr. C.'s "reasonable considerations" sooner, but the unavoidable occasion of the delay will be apparent, when he informs him, that he takes the Mechanics' Magazine in *monthly* parts. "The Author of the Voice of Reason" has no objection to "*reasonable considerers*," and begs to express his acknowledgements to Mr. C., for having afforded him a few more materials to work upon, in order to throw a little more light upon a subject, which some have appeared a little too *hasty* to clap their extinguishers upon. It is some times fortunate, that nature has implanted an instinct in some parents, whether successfully or not, to *defend* their offspring." So much for "freedom of inquiry." (No. 401, page 111). It is to be hoped the Ed. M. M., our Master of (Mechanical) "Ceremonies," will ever uphold it; and in future curb the *first* aggressor.

Ed. V. R.

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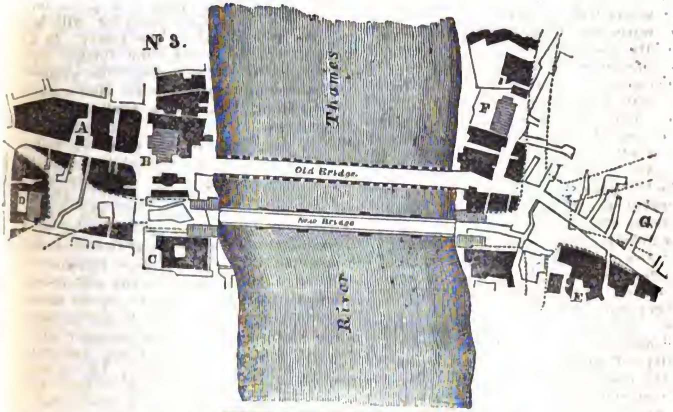
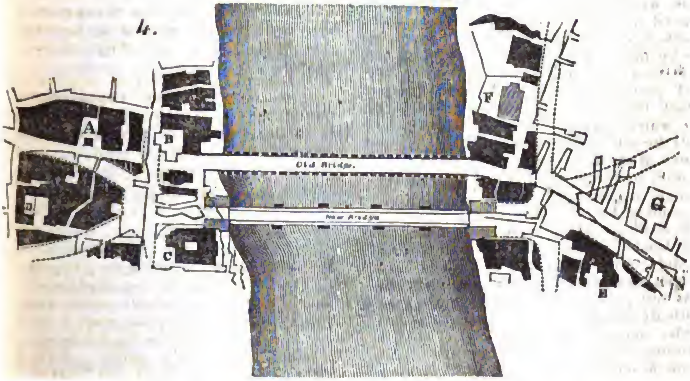
DESCRIPTIVE ACCOUNT OF THE PRINCIPAL BRIDGES ERECTED OVER THE RIVER THAMES. BY MR. C. DAVY, ARCHITECT.

No. XXI.

Concluding Paper on the Approaches to New London Bridge.





In December, 1827, Mr. Gwilt prepared a plan for the approaches on the south side of the new bridge, and submitted the same to the Lords of the

Treasury, the Lord Mayor, and others. This plan, however, differs so little from the one before mentioned as designed by Mr. Allen, that a description is rendered unnecessary. The very liberal and honourable conduct of Mr. Gwilt towards Mr. Allen, and others, merits particular notice. I am totally inadequate to do justice to his discriminating feeling, and therefore shall be content to extract the latter part of his address to the Lords of the Treasury:—

> "The plans and observations of Mr. Allen having been circulated in the City while this was preparing for the press, the similarity between his plan for the approaches on the Surrey side and mine is so striking, that it may be necessary to vindicate my claim to a priority as well as originality of design. I understand that gentleman has dated his plan from the day when the idea first occurred to him, viz. December 18, 1827. Now, mine was so far matured and executed *on paper*, that it was exhibited to a friend on the 15th of December; to the Chairman of the London Bridge Committee on the 26th of December; to John Rennie, Esq. on the 4th of January, 1828; to C. N. Palmer, Esq. M. P., Robert Slade, Esq., and twenty or thirty other gentlemen, on the 31st of January; finally, to the London Bridge Committee on the 21st of April, having been previously offered to their notice (without success) on the 11th of February. At the same time, I do not mean to insinuate that my ideas have been improperly pirated by Mr. Allen: on the contrary, I cannot help thinking the scheme is so natural, simple, and advantageous, that any two professional persons devoting their serious attention to the subject are very likely to hit upon the same idea. I have, therefore, dated my plan on the 14th of December, 1827, although some minor additions and improvements have been made since that date."

The plan proposed by Mr. Lund, of Cornhill, bears the date of November 19, 1828, and was addressed, as usual, to the Lord Mayor and the gentlemen of the New London Bridge Committee. It attracted much attention at the time, but may be described without the assistance of a drawing. The plan only embraces the approaches for the City side. It was proposed, in the first place, to form the line of Thames-street as much to the northward as is the present width of the street, or nearly so, (see the plan in the Repertory, vol. vii. N. S. p. 361) and to continue a street from the foot of the new bridge, in an inclined direction, towards the end of Fenchurch-street. A wide opening was to be formed opposite the Monument, similar to that in which the Monument now stands, to be called Monument-place. The slanting street shown and marked in the plan "Great George-street," would have entered upon Gracechurch-street and Fish-street-hill at Great Eastcheap. The land-arch in Thames-street was also first proposed by this projector. The other parts of Mr. L.'s plan also would not have interfered with those of other parties. The line from the new bridge to the Bank, Royal Exchange, &c., might still have been executed. Mr. Lund states, that the most novel part of his plan "is to approach the City and the bridge from both the Thames-streets by inclined planes (built upon arches) of corresponding appearance and rise, on the north side of, and parallel with Upper and Lower Thames-streets, of such a width as to leave a sufficient roadway for two or three carts; a narrow foot-path on the south side, next to, and chiefly to protect the stone balustrade or parapet; and a broad foot-path on the north side of the intended rises, next the houses, for passengers."—*Lund's Report.*

I have now brought under the notice of your readers all the most important plans that have been submitted from time to time for this extensive undertaking.

Under the pretence of benefitting the public, a powerful opposition was got up for the purpose of showing the ruinous effect which would be produced upon trade by the adoption of the land-arch over Thames-street. Persons were employed to ascertain the number of vehicles, &c. that passed during the day, in order that the amount of compensation for premises might be swelled to an appalling sum. The petty, grovelling spirit that has hitherto marked so many public improvements, and heretofore cramped the genius of Wren, fortunately failed in this instance, as a few of the claims and verdicts hereunder given will sufficiently show. But first of the vehicles, &c.

"*An Account of the Daily Average Number of Carts, Waggons, Coaches, Chaises, &c. which passed as under on the* 16*th and* 17*th of May*, 1828, *and* 13*th and* 14*th of June*, 1828, *between* 6 *o'Clock A. M. and* 8 *o'Clock P. M.*

	Carts.	Coaches.
From Upper Thames-street over London Bridge......	400	13
Lower Thames-street over ditto....................	376	28
City over ditto....................................	2,829	773
Borough over ditto.................................	2,700	767
London Bridge to Upper Thames-street.............	453	16
Ditto to Lower Thames-street.......................	375	32
Upper to Lower and from Lower to Upper Thames-st..	383	22
Fish-street-hill to Upper Thames-street..............	87	7
Ditto to Lower Thames-street.......................	166	21

The number of persons who came with loads over London Bridge in one day from Lower Thames-street was 862."*

Claims and Verdicts for Premises in Southwark.

	Claims.			Verdicts.		
	£.	s.	d.	£.	s.	d.
Lease and good-will..............	23,937	3	4	12,700	0	0
Ditto..........................	3,704	8	0	1,752	0	0
Freehold and good-will...........	31,121	12	0	18,067	5	0
Lease and ditto....	3,250	0	0	2,740	1	0
Ditto ditto..............	2,071	16	0	883	0	0
Ditto ditto...................	3,160	17	0	639	15	0
Ditto ditto...................	4,671	17	6	2,710	8	0
Freehold........................	3,300	0	0	2,600	0	0
Lease and good-will...............	4,170	7	0	2,126	0	0
Good-will........................	923	15	0	220	0	0
Freehold........................	4,190	0	0	2,200	0	0
Lease and good-will..............	4,018	1	6	485	14	6
Ditto ditto..................	2,110	0	0	887	8	6
Ditto ditto..................	2,596	13	6	1,626	1	6
Ditto ditto..................	2,450	0	0	1,412	6	6
	95,675	10	10	50,450	0	0

The excess of claims on the part of 15 claimants only, was no less than £45,225. 10*s*. 10*d*.!

On the City side the claims were £87,917, and the verdicts £33,004; besides which, the cost of compromises without verdicts was upwards of £150,000: the whole not exceeding one-fifth part required for the approaches. Accompanying this paper are the 3rd and 4th plans for the approaches, by Mr. Rennie, alluded to in the schedule. The same letters of references apply to both plans. A, the Monument; B, Fishmonger's Hall; C, St. Magnus Church; D, St. Michael's; E, St. Mary Overy's, or St. Saviour's; F, St. Olave's; G, St. Thomas's Hospital.

(To be continued.)

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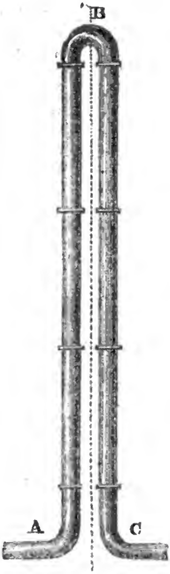
* Repertory.

FALLACY IN WATER-WORKS.



Sir,—It is by no means surprising, that persons who are unacquainted with the elements of natural science, should be misled by the deceptive appearance of the syphon; but, that such a circumstance should occur with men, who have been professionally engaged for years, in the construction or superintendence of hydraulic machinery, is almost incredible. Nevertheless, in the course of observation, we do sometimes meet with arrangements, which display an unfortunate misconception of scientific principles.

I wish, on the present occasion, to offer a few remarks, on what appears to me to be a *fallacy in water-works*—I allude to the use of, and the undue importance given to, THE SYPHON.

In a conversation, which I had a short time since with some gentlemen connected with some extensive water-works, I was informed, that at their works they always had a pressure on their mains equal to a column of water forty feet high; which pressure they obtained by passing the water through a syphon of that height!

And this pressure was held to be equal that, which would be given by a reservoir of the same elevation. Nor is this the only case in which a similar arrangement has been adopted with the same view.

It is not necessary, in considering the case now before us, to enter into a detailed account of the general mechanical arrangement of water-works; on the contrary, the accompanying sketch of the syphon, detached from the works, is all that is requisite for my purpose. Let A represent the pipe coming from the pumps and other machinery, employed for raising the water; C, the pipe leading into the several mains. When the engines are first set to work, the water is forced up the left limb of the syphon to the bend B, a height of forty feet.

In raising the water to this point, the engine has to exert a force equal to overcome the resistance of a column of water of the height stated; but, in a short time the water will have filled the right limb of the syphon, and entered the mains. The column of water AB, which was before supported by the power of the engine, will then be nearly counterbalanced by the equal column BC, on the other side the perpendicular line.

The greater portion of the load will therefore be taken off the engine, and it will then have little more work to do, than to overcome the direct resistance from the mains. So that while the engineer is of opinion, that the engine must be supporting a column of water forty feet high, in consequence of the interposition of the syphon—it is very frequently, in fact, only supporting a *few feet*, instead of *forty*. If the engineer is right—and all the parties concerned, stoutly maintain that he is—how is it, that it frequently happens while the engine is working through the forty-feet syphon, it will not send water into a cistern *less than ten feet high*, within two or three furlongs of the works?

It is true, that the effective action of the syphon is limited by the range of atmospheric pressure, *i. e.* to about 33 feet; and, therefore, in a syphon forty feet high, a pressure equal to about 7 feet, may be calculated upon; but this is the utmost. This view corresponds pretty nearly with the results which are obtained, and the limits to which they are confined; and goes to explain certain phenomena, which, under the supposition, that the syphon really gives a pressure equal to a reservoir of similar attitude, are altogether inexplicable.

Although it is highly desirable, and comparatively easy, to obtain the effect of an elevated reservoir, when a capacious one cannot be obtained; yet, nothing can be more fallacious than the idea that such an effect is obtained by the use of a syphon.—Yours, &c.

Wm. Baddeley.

London, May 6, 1831.

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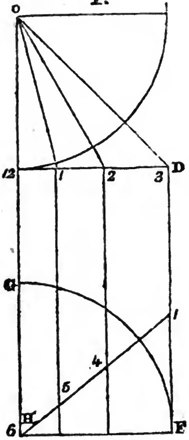
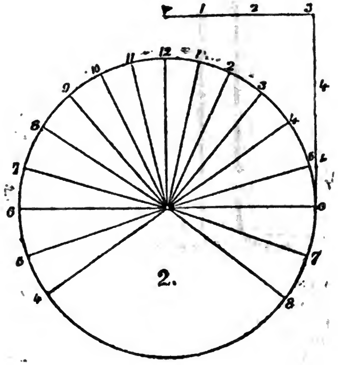
A NEW DIALLING SCALE, ON THE PRINCIPLES OF FERGUSON'S DIALLING CYLINDER.

1.





Sir,—The following scale may be easily constructed on the principle of Ferguson's Cylinder; and, if made of a large size in brass, and accurately graduated, will be as convenient for use as the instruments now used in the construction of sun-dials by instruments alone.

Construction of the Scale. Fig. 1.

With any convenient radius, and centre O, describe a quadrant, and divide half of it into three equal parts. From O draw O H, and ⊥ to it draw 12 D. From O, draw O 1, O 2, O 3, through the equal divisions of the arc, to intersect 12 D in the points 1, 2, 3; and from these points, draw lines parallel to O H. With radius HF = 12 D, in centre H, describe an arc G F, and draw H F, making an ∠ with O H = to the latitude for which the dial is to be made; and now the scale is ready for use, and a dial may be constructed by it as follows.

With radius 12 D, describe a circle, and draw its diameter 6·6; ⊥ to which draw 6·3 = H F, and on it mark off the divisions 6, 5; 5, 4; 4, 7, (in fig. 1). Draw 1, 2, 3, parallel to 6, 6, and set the divisions in fig. 1 on it, as before. Lay a ruler on the centre of the circle, and on each of the divisions, and draw lines to the circumference; which lines will determine the position of the hours for the afternoon, and by setting off equal dis tances on the circumference in the other quadrant, and drawing the lines 7·7, 8·8, 5·5, 4·4, through the centre, an horizontal dial will be constructed, with all the hours from 4 A. M. to 8 P. M.; and, in like manner, a vertical N. or S. dial may be constructed, using the complement of the latitude, instead of the latitude itself.—Yours, &c.

J. GREENALL.

ARCHITECTURE OF BIRDS.*

The Society for the Diffusion of Knowledge have been blamed, and with some appearance of justice, for displaying a too great fondness for minute subjects in their Entertaining Series. No one could possibly object to the *occasional* introduction of a treatise on the minuter branches of natural history, especially when treated in the style in which they have hitherto been in the Society's publications: but it must be allowed, that, out of the few volumes—nine or ten—of the entire series which have as yet appeared—there are too many devoted to this one subject, or division of a subject. We hope the Society will look to this, and favour the world with many volumes of more general interest, and a wider scope, ere they send forth another on "Insect Transformation," or the "Architecture of Birds."

The present work is devoted to the description of the various nests of the different species of the feathered race; but it also includes a considerable part of the science of ornithology, as the whole life and habits of the little architects are sometimes detailed. There is, as usual, a very conspicuous want of method in the arrangement; and had any order whatever been followed, we cannot help thinking the improvement would have been great and manifest: at present, it is quite impossible to tell under what chapter any particular bird may be found, without consulting the index—an inconvenience which is by no means an inconsiderable one, and which the author would do well to remedy should an opportunity occur.

Most persons at all acquainted with the literature of the day are pretty well aware, that those volumes of the Library of Entertaining Knowledge which refer to natural history, are the production of Mr. Rennie, a gentleman, who, notwithstanding his connection with the principal supporters of the London University, has been most liberally appointed Professor of Natural History in King's College, the rival establishment. The readers of "Insect Architecture," and "Insect Transformations." in former volumes of the Entertaining Library, as well as those of most of our scientific periodicals, are well acquainted with his love of Nature, and his industry of observation—qualities which are not less conspicuous in the little work before us. Another, however, must be allowed to share the honours of authorship in the present production, for at least half of its pages have been extracted from that magnificent work, Wilson's American Ornithology, of which we are glad to see an English edition announced, under the superintendence of Sir William Jardine, the talented editor of the Constable Miscellany's edition of White's Natural History of Selborne. Respecting the extraordinary man who wrote that work, and whose name must ever be pronounced with reverence by the mechanics of Great Britain, of whose ranks he was once a member, we find the following highly interesting notice in the work we are reviewing—a notice which ought to excite feelings of exultation and delight in the breast of every brother-mechanic of ALEXANDER WILSON:—

"With an enthusiasm never excelled, this extraordinary man, *who went to the United States a poor and unfriended Scotch weaver*, first taught himself, at the age of 40 years, to draw and colour after nature, then applied himself to the study of various branches of knowledge; and, having acquired the power of writing clearly and elegantly, as well as of depicting by his pencil what he saw in his rambles, set out to penetrate through the vast territories of the United States, undeterred by forests and swamps, for the sole purpose of painting and describing the native birds. During seven years, in which he prosecuted this undertaking, he travelled more than ten thousand miles, 'a solitary, exploring pilgrim,' as he describes himself. His labours were rewarded with no worldly riches or honours, for he had the greatest difficulty in procuring subscribers for his splendid work, and when a bookseller at last, undertook to print and publish it, the only remuneration which the author received, was a payment for the mechanical labour of colouring his own plates. But his soul was set upon the one object of his life—that of giving a complete account of one of the most interesting portions of the works of the Creator, as far as the vast Continent of North America afforded him opportunities for diligent examination."—p. 5.

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* Library of Entertaining Knowledge: the Architecture of Birds, by J. Rennie, A.M. Professor of Natural History in King's College, London. London: Charles Knight. Small 8vo. pp. 390. 1831.

This notice confirms us in the idea we threw out in our review of the "Pursuit of Knowledge under Difficulties," that the subject of that volume might have been pertinently illustrated with examples drawn from recent Biography, instead of being confined to those of every generation but the present. In fact, we are convinced that a third volume on the same subject, with anecdotes of living, or lately-deceased persons only, would prove the most interesting of the whole:—we hope the Society will adopt the hint.

As we have said, Wilson's work furnishes a very considerable portion of the contents of the volume—a circumstance, which is perhaps to be regretted, as it might have been best to give in one book the Architecture of British Birds only, the facts of which might be verified by the reader's own observation,—and then, if necessary, to have afterwards published a complete abridgement of Wilson's Ornithology separately—for, in the present course, the transitions from England to America, from our commonest household birds to the rarest-winged habitants of the Transatlantic Continent, are so abrupt as to destroy all harmony of association.

The following remarks on a favourite hypothesis, strike us as being extremely to the purpose, and, indeed, as setting the question, if question it ever was, completely to rest.

"Although the notion that man derived the first hints of mechanical contrivance from the lower animals, may at first view appear plausible, it will be found, when traced circumstantially, no more to accord with the actual origin of inventions, than the once popular fancy of tracing the origin of all human knowledge to the Iliad of Homer, or as the Turks do, to the Koran of Mahomet. Pope, who was essentially the poet of good sense and reason, doubtless believed that some arts were thus acquired, when he said,

'Learn of the little Nautilus to sail,
Spread the thin oar, and catch the driving gale;'

but the fact itself appears very questionable, inasmuch as the various species of nautilus (*nautilæ*) are not only of rather infrequent occurrence where they are indigenous; but, being confined to the locality of warm latitudes, they could not have afforded any hint of boat-building to many tribes, such as the Esquimaux or the New Zealanders. We might, apparently, with as good reason, attribute the invention of paper-making to wasps: but the recorded history of paper would disprove the theory; for the manner in which wasps make paper was not known previous to 1719, though Reaumur had endeavoured to discover it for twenty years.

"Following up the principle of ascribing human inventions to the inferior animals, we might, in a similar manner, trace the art of mining to a rabbit-burrow, or a fox-earth; or, to come to our immediate subject, to the mined holes of the bank-swallow or the sand-martin."—p. 17.

These rational considerations, however, do not prevent our author from falling into what we have always considered another vulgar error—comparing the monotonous ingenuity of certain insects and birds with that of the nobler animal, man. The absurdity of this idea must, we think, be apparent to every one who has ever wasted half-a-minute's reflection on the subject; and we are sorry to see it adopted by so acute an observer as Mr. Rennie. Doubtless, many of the facts he adduces, as to the mechanical dexterity of birds, are sufficiently surprising, more especially those which relate to the extraordinary nests of the grosbeak of Africa, where whole tribes take up their residence in one enormous mass of nicely-executed basket work. The details of the housebuilding of this species are very interesting, and given at considerable length; but we prefer extracting the account of our British basket-makers.

"After the preceding details of what we may well call the marvellous efforts of birds in basket-making, some of our own little mechanics may not appear to much advantage; though their more slender structures are equally suited to their mode of breeding, and exhibit no small skill in the management of the materials. The nests which we allude to are those of several of our summer warblers, some of which, though built by different species, are so like in appearance, that it requires some experience to distinguish them. Amongst these we may mention the white-throat, and the babillard, which are known under an endless variety of provincial names, such as *Peggy*, *Wheetie-why-bird*, *Muff*, *Charlie-muftie*, *Churr*, *Hay-tit*, *Nettle-creeper*, *&c.* The nests of these two are not distinguishable in the size, although the birds differ considerably in this respect, each nest being rather more than two inches in diameter within. We should at first deem it impossible to bring the dry, brittle stems of catchweed into a smooth, round form, yet this is the usual material of the framework employed by these little mechanics, though no sort of dry, slender stem comes amiss. These are woven together in the bosom of some low bush of brambles or thorns, as Sepp has accurately figured it, sometimes so lightly, that the light shines through the meshes, while at other times the structure is of considerable thickness. A few long horse hairs are wound neatly round the interior, with some finer grass. In several nests in our possession, however, the hairs are in quantity sufficient to cover the basket-work of grass from the eye. Whence Mr. Bolton derived the notion that the white-throat uses spiders' webs as a binding material, we cannot imagine; for, out of some twenty specimens now before us, we can detect nothing of this sort. It is the rough reflexed prickles of the catchweed which binds the exterior, and the hairs (probably glued with saliva), which keep the inside in shape. The chief distinction which we have detected in the nests of these two species, is, that the white-throat for the most part makes use of a few roots in lining, which the babillard never does; while the latter seems fonder than the former of working tufts of willow down from the brim of the nest. According to Montague, the nest of the Dartford warbler is very similar to that of the white-throat, but usually contains furze twigs, and is built in the top of a furze-bush, where the former would not be likely to occur. Though this bird is said not to be rare on the heaths in the neighbourhood of London, we have not met with its nest. We observed the bird itself on Blackheath, suspended over the furze, and singing on the wing like a white-throat or a titlark, as early as the end of February, 1830; whence we concluded, that, notwithstanding the severity of the frost, it had wintered here, as it is known to do in Devonshire.'—P. 231.

With this extract we must conclude. The work is got up in the usual style of the books sent forth by the Society, although we feel bound to observe, that the wood-cuts are, although far from despicable, not such as we might naturally look for when that species of engraving has been brought to such a pitch of perfection as it has risen to in the present day. Many of them are extremely coarse, and we cannot but think, that if a publisher, and not a Society, had had the getting up of the book, these things would have been managed better.

We are happy to observe, that Mr. Rennie has announced a new edition of that valuable work, Montague's Ornithological Dictionary, of which, indeed, he has made ample use in the present publication—And, we hope, that, for the future, the "Library of Entertaining Knowledge" will be more regular in its times of appearing—for, we believe it is nearly half-a-year since the publication of the volume immediately preceding the "Architecture of Birds."

◆

Kites.—Sir, In the number of your Magazine for last Saturday, a correspondent suggests the use of kites for various purposes in nautical affairs. I beg leave to add one to the number. Supposing a vessel to have struck on shore (or near to shore), a kite might be hoisted with great rapidity, with a magazine of powder attached, of about 2 pounds weight, to be fired by a fusee to explode in a certain time, by which means the kite would be disengaged or destroyed, and the rope, with a grapuel previously attached, would fall to the ground. The people on shore could then haul a rope from the ship, and so save the people on board.—Yours, &c., F—— S——. —*London, May* 25, 1831.

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INTERIM NOTICES.

We cannot gather from Mr. I. Dudley's note whether he disclaims the pamphlet alluded to, or not.

Communications received from P. W.—Mr. Fowler—A. X.—D. I. E. F.—Mr. G. Davies—A Young Geometrician—A Reader at Birmingham—Mr. J. Baynham—Dr. Pearce.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street, where Communications (post paid) are requested to be addressed.

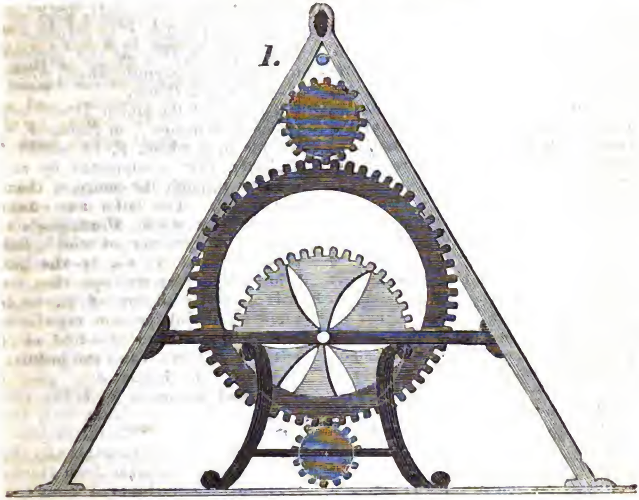
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 409.] SATURDAY, JUNE 11, 1831. [Price 3*d*.

BERTIN'S ACENTRIC WHEEL.

1.



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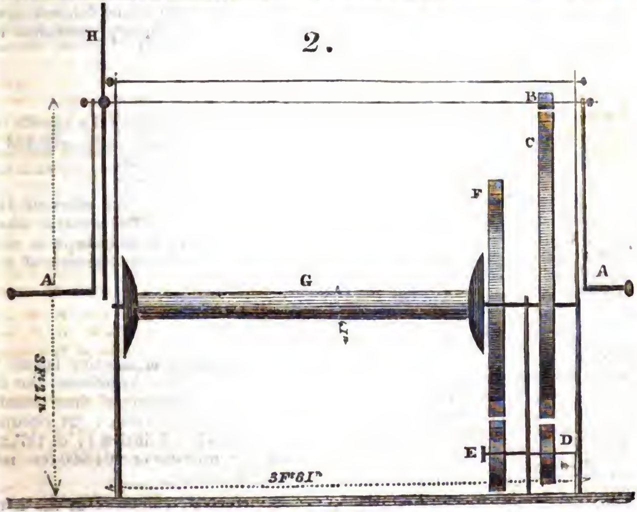


DESCRIPTION OF A NEW WHEEL, PARTICULARLY APPLICABLE TO CAPSTANS AND SAW-MILLS, INVENTED BY MR. BERTIN. WITH A COMPARATIVE SUMMARY OF EXPERIMENTAL RESULTS—COMMUNICATED BY THE INVENTOR.

The name *Acentric* has been given to a wheel, that has neither axis nor radii, and which, consequently, does not revolve round a pivot, like ordinary wheels. It is compounded of the word *centric*, and the privative monosyllable *a* of the Greeks: it, therefore, conveys the idea of a wheel that moves without resting on its centre or fulcrum.

The construction of the acentric wheel is such as to afford a new and advantageous application of the curved lever in machinery: properly speaking, it is nothing more than a ring indented on its convexity, and capable of being so on its concavity if need be, and which revolves on its interior upon an arc of a circle furnished with steel rollers, and firmly secured upon a strong prop.

The acentric wheel may be applied with advantage in every machinery whatever: the first use derived from it has been in the construction of capstans and saw-mills.

Fig. 1 is an end view, and fig. 2 a side view of this wheel.

On an iron frame, an axis has been disposed, with a crank at one end, A, its radius measuring 12 inches $\frac{7}{8}$; at the opposite end of the axis is fixed a pinion B, 3 inches $\frac{3}{8}$ in diameter, and which we call the moving pinion. This pinion catches in the cogs or notches of an acentric wheel, C, 25 inches $\frac{6}{8}$ in diameter.

This wheel, C, indents also with a pinion, D, 4 inches $\frac{5}{16}$ in diameter, fixed on a separate axis, at the opposite extremity of the acentric wheel, where the moving pinion B acts.

The axis of the pinion D also bears a pinion, E, 6 inches $\frac{7}{16}$ in diameter, which indents in a wheel, F, 17 inches $\frac{4}{15}$ in diameter, that is supported by an axis running through the centre of the acentric wheel. The latter axis moves a cylinder, of cast iron, 4 inches $\frac{5}{16}$ in diameter, on which the power of resistance is made to act. It is a fly-wheel, 3 feet 2 inches $\frac{5}{8}$ in diameter.

It is easy, with these data, to determine by calculation the ratio between the power of motion and that of resistance, when there is an equilibrium: this ratio is as 1 to 37 $\frac{2}{11}$.

To show the saving of labour effected by means of the acentric wheel, the following comparative statement has been drawn up. The performances in the left hand column are taken from Hachette's "Traité des Machines Elementairés:" those in the right-hand column are the results of experiments carefully made with the new wheel.

Comparative Statement.

A man acting upon the handle of a wheel and axle, effected 116 great dynamic unities.	A man acting upon the handle of an acentric wheel and axle, effected 147 great dynamic unities.
According to Coulomb, the force exerted by a man for a continuance of action on the handle of a winch does not exceed 14 lbs. In general, the velocity of rotation of the handle of the winch is such that a given point in it describes in a minute, from 20 to 22 circumferences of 7 feet 7 inches $\frac{2}{8}$ each.	A man exerting an effort of 14 lbs. upon the winch of an acentric wheeled capstan, makes it describe in a minute from 24 to 26 circumferences of 6 feet 7 inches $\frac{2}{8}$ each.
The duration of effective labour is about 6 hours in a day. Upon this hypothesis the daily action is the product of three numbers, 14 lbs.; 6 h. × 60 min., 20 circumferences, × 7 feet 7 inches $\frac{2}{8}$; or 116 great dynamic unities, or 232,000 lbs., raised 3 feet 3 inches $\frac{5}{8}$.	The duration of effective labour is 6 hours: upon this hypothesis, the daily action is the product of three numbers, 14lbs: 6 h. × 60 min.: 24 circumferences, × 6 feet 7 inches $\frac{2}{8}$; or 147 great dynamic unities, or 294,000 lbs. raised 3 feet 3 inches $\frac{5}{8}$.
According to the foregoing calcu-	A workman employed at the handle

lations, a workman employed at the handle of a wheel and axle, performs as follows:

1st. With an exertion of 14 lbs. he lifts 644 lbs. in one minute, with a velocity of 3 feet 3 inches $\frac{4}{8}$, to 20 circumferences of 7 feet 7 inches $\frac{2}{8}$ each.

2nd. With an exertion of 14 lbs., he raises 214 lbs. 8 feet 7 inches in 20 circumferences of 7 feet 7 inches $\frac{2}{8}$ each.

of an acentric-wheel and axle, performed as follows:

1st. With an exertion of 14 lbs. he lifts 818 lbs. in one minute, with a velocity of 3 feet 3 inches $\frac{4}{8}$, to 24 circumferences of 6 feet 7 inches $\frac{4}{8}$ each.

2nd. With an exertion of 14 lbs., he raises 307 lbs., 8 feet 7 inches, in 24 circumferences of 6 feet 7 inches $\frac{4}{8}$ each.

General Summary, showing the daily result with the same expenditure of force, and with equal velocity.

By the old Machines.

In 6 hours of effective labour, exerting constantly an effort of 14 lbs., a man has raised:

1st. 232,000 lbs. 3 feet 3 inches $\frac{4}{8}$.

2nd. 77,000 lbs. 8 feet 7 inches.

By the Acentric Wheel.

In 6 hours of effective labour, exerting constantly an effort of 14 lbs. a man has raised:

1st. 294,807 lbs. 3 feet 3 inches $\frac{4}{8}$.

2nd. 98,269 lbs. 8 feet 7 inches.

It is to be observed, that in making this comparative calculation, all circumstances have been supposed equal, except the usage of the acentric-wheeled capstan.

It is easy to conceive, from these explanations, the great advantages to be derived from the use of the acentric wheel. They are proved by the comparison just made between the capstans on the old and new system; and similar benefits may also be derived from every description of rollers where the acentric wheel is used.

In fine, it may be substituted with equal advantage to the wheel conveying the power of motion in hydraulic machines, steam-engines; in cases requiring a high degree of pressure; in wine, cider, and oil presses, &c. &c.

WOOD ON RAILWAYS.

(Concluded from page 215.)

Mr. Wood adds to his narrative of the Locomotive Competition of 1829, an account of some experiments subsequently made with the Novelty and Rocket, after they had undergone considerable improvements; and also with the Phœnix (erroneously called in one place, p. 400, the Meteor), and Arrow, two new engines constructed by Mr. Stephenson.

The following Table shows the comparative economy of these different engines, as determined by these experiments, and contrasted with the Sans Pareil:—

No.	Engines.	Average rate of speed in miles per hour.	Consumption of coke in lbs. per ton per mile.
1	Rocket..........	14	2·41
2	Sans Pareil......	15	2·47
3	Novelty.........	8	0·918
4	Phœnix.........	12	1·42
5	Arrow..........	12	1·25

Mr. Wood thinks, that the consumption of the Phœnix (No. 4) may be taken as a fair practical average; but Mr. Stephenson has informed him, that "from some recent experiments, he finds the economy of the Planet engine much greater, and that ·666lbs. per ton. gross, or 1 lb. per ton. of goods, will cover all waste with that engine." He observes, however, very truly, that "*the power* is in strict proportion to the quantity of water, which the engine is capable of evaporating *in a given time*:" and he favours us with another table, illustrative of the capabilities of three of the engines, in this point of view:—

Engines.	Quantity of coke consumed in lbs.	Quantity of water evaporated in gallons.	Gallons of water evaporated per hour.
Rocket..........	650	370	185
Arrow..........	900	550	275
Phœnix..........	850	430	215

The power to be assigned to these engines, in virtue of the quantities of steam generated by them respectively; Mr. Wood thus estimates:—

"The power being, as before stated, in strict proportion to the quantity of water evaporated, or steam generated per hour, we have in the "Arrow Engine" 275 gallons, equal to 501,328 cubic inches of steam, at 50 lbs. pressure per square inch, evaporated per hour. This will give 2,088,866 lbs. pressure per foot per minute; and if we take 30 per cent. as the effective power, we have 626,659 lbs. moved one foot per minute. If we suppose 15 miles per hour, or 1320 feet per minute, the average rate of travelling, this quantity of steam would give 474 lbs. moved at that rate; we may, therefore, safely estimate the powers of these engines at 30 tons gross, conveyed at the rate of 15 miles per hour, including any casual stops; which would leave 174 lbs. for that resistance which is peculiar to those engines; or the power expended in effecting their locomotion, which is considerably greater than is required; being only the resistance of the axles, and the wheels upon the rails, more than that of ordinary engines."—P. 413.

"But," Mr. Wood very prudently adds:

"In assigning this performance, we trust we have kept quite within the capabilities of these engines, even in their present state of improvement. We cannot, however, suppose that they will remain in this state; the powerful direction of public attention to them, and the very important consequences likely to result from the economy and dispatch in interior communication, will doubtless ensure them further improvement; and, therefore, in assigning a performance equal only to their present capabilities, we are liable to fall into the same error as in the former edition of this work. Still we prefer this mode, rather than to affix a performance which depends upon adventitious circumstances; and which, if not realized in practice, might be attended with injurous consequences."—P. 414.

It would seem, however, that the "march of improvement" had overtaken Mr. Wood, even while committing this saving clause to the press; for though he here estimates the maximum effect of the best engines now in use, to be only 30 *tons gross weight*, *conveyed at the rate of* 15 *miles an hour*, he shortly afterwards gives an account of some performances, by a still newer engine of Mr. Stephenson's, called the "Planet," which exhibit a more favourable result by twenty-five per cent.

"The cylinders (of the Planet) are 11 inches diameter; length of stroke, 16 inches; area of cylinders, = 190 inches, which moved through 32 inches in each revolution of the wheels, = 6080. The diameter of the wheels is 5 feet; circumference, 188·4; the resistance of 40 tons is 400lbs., whence 188·4 × 400 = 79360; therefore, $\frac{79360}{6080}$ = 13lbs. per square inch upon the piston, effective pressure, to overcome a resistance equal *to 40 tons, moved at the rate of* 15 *miles an hour*; which, with steam of the elasticity of 50lbs. per square inch, is an effective pressure of 26 per cent. The number of strokes per minute being 84, velocity of piston 224 feet per minute. We shall now ascertain if the boiler is capable of generating a sufficient quantity of steam to keep up an adequate supply at 50lbs.

> pressure per square inch. The area of the two cylinders is 6080×84 strokes per minute = 510,720 cubic inches of steam expended every minute. We find that the Arrow, whose powers of generating steam is not equal to the Planet, evaporated 275 gallons per hour, or 458 gallons (query, 4·158 gallons?) per minute; which will give about 501,326 cubic inches of steam at 50lbs., or 510,720 cubic inches at 49lbs. increasing the effective pressure from 26 to 26·5 per cent. We have previously found that these engines are capable of yielding an effective power of upwards of 30 per cent. of the pressure on the piston."—P. 420.

Mr. Wood adverts also to the still more remarkable results latterly obtained by Messrs. Braithwaite and Ericsson, through the substitution of the exhausting process for the blast; and frankly admits, that more is to be expected from engines with boilers on their plan than from any of Mr. Stephenson's:—

> "The principle of exhausting or producing a current of air for combustion by mechanical means, *allows the whole of the useful heat to be abstracted*—none being required to produce a draught in the chimney, as in engines, the process of the combustion of the fuel in which is kept up by the rarefaction in the chimney; and, therefore, we should expect in time a considerable effect produced, both in the economy of fuel and also of performance."—P. 411.

Mr. Wood gives (in his Appendix) the statement by Messrs. Nimmo and Vignoles of the "experiments made at Mr. Laird's works, Birkenhead, with a low-pressure boiler on the exhausting principle of Messrs. Braithwaite and Ericsson," (see Mech. Mag. vol. xiii. p. 235) and the result of these experiments he admits to be "surprising." But he thinks this result may have been owing "to the length of the flues"—45 feet—a length which he imagines it would be "rather difficult to obtain in a locomotive-engine." Why difficult? The length of the tube in the Novelty was 36 feet, and that was an engine, taken altogether, of remarkably small dimensions. It seems to us, however, that Mr. Wood misapprehends the principle of Messrs. Braithwaite and Ericsson's boiler, when he supposes that an extreme length of tube is necessary to its successful developement. That principle consists in generating a greater quantity of steam in a given time from a given extent of tubular surface, than has ever hitherto been done. Neither does the efficiency of the new method Messrs. Braithwaite and Ericsson have adopted for this purpose rest on the experiment at Birkenhead; for there has been a "locomotive-engine" actually constructed on their exhausting plan; and, so far as regards the matter of generating steam, worked with the greatest success. We allude to the William the Fourth. What the length of its tube is we do not at present recollect—whether 30, 40, or 50 feet—but this much is certain, that with such a length of tube as has not increased the total weight of the engine beyond six tons, (about the weight of the Planet) it produced even a greater quantity of steam than the stationary-boiler at Birkenhead. The quantity of water evaporated in the course of one hour, in the experiments related by Messrs. Nimmo and Vignoles, (and which Mr. Wood calls "surprising") was 41½ cubic feet; while the quantity evaporated in a trial with the William, on the 24th of September last, during the same time, was 48 cubic feet (see Mech. Mag. vol. xiv. p. 365.) Now, as Mr. Wood has said, and said truly, "the power being in strict proportion to the quantity of water evaporated, or steam generated, per hour," and the quantity evaporated by the William being greater than what is recorded in Mr. Wood's book of any of Mr. Stephenson's engines—we cannot surely have been far wrong in maintaining (vol. xiv. p. 40), that it must be owing—not to any defect in the principle of this engine—but "to some defect in the details of the machinery, admitting of a remedy, or some unskilfulness of management, which ought not to have occurred," that it has not ere now surpassed in its performances any engine produced by Mr. Stephenson prior to the date of Mr. Wood's publication. The boiler of the William appears to have done its duty admirably, but the boiler has not had fair play.

Mr. Wood anticipates that the *weight* of the engines "will be reduced as improvements go on;" but, as usual with him, the prediction and the event—so far as we have yet penetrated into the future—are very much at variance. The weight of the Planet is between five and six tons; the weight of the Samson, which has recently performed such wonders, is nearly nine. We rather think there is but little to be hoped for on the score of reduction in weight—on plain rails, at least, where as you increase the weight drawn, you must of necessity increase the weight of the moving power, in order to obtain the requisite gripe or adhesion. If we are right in our view of the matter, the following observations by Mr. Wood, on the propriety of meeting an increase in the weight of the engines by an increase in the strength of the rails, will be found particularly deserving of attention from railway proprietors:—

> " When we consider the trifling proportion which the additional weight of a few pounds per yard of iron, applied to increase the strength of the rails, bears to the whole cost of the railway, we cannot suppose that the addition of 20 or 30 cwt. in the weight of an engine above that of the ordinary carriages will be put in competition with the permanent economy in the means of transit by such a trifling increase of expenditure. At the same time, we beg to be understood, that we are not an advocate for the use of heavy engines, but only for the application of engines of such powers as are capable of effecting a maximum result; if such can be applied without more injury to the rails than what arises from the common carriages; or if such application can be effected with a like result by the addition of a few pounds' weight of iron per yard. On the Liverpool and Manchester line the entire cost of the rails constitutes less than 6 per cent. of the whole expense of the railway; and that weight per yard which would increase their strength more than one-half, would not be equal to 2 per cent. of the whole expenditure, or 2*s*. 6*d*. per lineal yard of single railway."—P. 416.

Whatever improvements may yet take place in locomotive steam-engines, it is certain that they must ever, and under all circumstances, be vastly superior to any animal power that can be employed. The following table, furnished by Mr. Wood, places this fact in a very striking light:—

	Velocity in miles per hour.	Load taken in tons.	Distance travelled per day.	Effective performance in tons, conveyed one mile.	Number of horses equal to the *Locomotive Engine.*
Locomotive Engine	12	45	96	4320	—
Horses..........	2½	12	20	240	18
	10	3⅜	13	43·8	98

The power of locomotive-engines, at all rates of speed, within those attainable by horses, is always the same; but that of the animal diminishes in proportion to his rate of going; and hence the prodigious disparity which the preceding table exhibits.

On the Stockton and Darlington Railway, where horses are still employed to perform part of the work, a very useful expedient has been adopted to increase their efficiency:—

> " Great part of the traffic upon that railway is in one direction; and portions of the railway in the direction which the load is to be conveyed, has a considerable descent, equal to that which causes the carriages to run of themselves. A low platform-carriage is provided and taken with the train; and upon the parts of the road where the descent is so great as to overcome the friction, and the carriages descend by the force of gravity, the horse is made to mount the platform, and is *carried down by the load*. The effect of this is, that the horse is enabled to perform a much greater distance than if he travelled the whole way; and it is astonishing how soon the horse becomes accustomed to and *fond* of subverting the adage, 'the cart before the horse,' by making *the cart carry the horse*. Mr. Story has favoured us with the following particulars of the increase of effect by the adoption of this expedient:—
>
> 'Previous to carriages being used for the horses to ride on, a week's work of 6 days, was—
>
> 87 miles, with 12 tons of coals, and 5½ tons empty carriages.
> 87 ditto, with 5½ tons empty carriages.
>
> Tot. 174 miles.
>
> 'A week's work after using the horse-carriage was—
>
> 120 miles, with 12 tons of coal, and 5½ tons empty carriages.
> 120 miles, with 5½ tons empty carriages.
>
> Total 240 miles.

And Mr. Story observes, "this is nearly 1-3rd more work, and the horses improved in condition, whereas, formerly the horses grew worse in condition."—P. 302.

Mr. Wood concludes with a Chapter on the "Comparative Performances of Motive Power on Canals and Railroads;" but as this has involved him in a controversy on the subject with the Forth and Clyde Canal Company, which we shall afterwards have occasion to notice—we shall content ourselves for the present with observing, that however erroneous Mr. Wood may be in a few of his deductions, he does not appear to us, upon the whole, to have materially over-rated the superiority of the Railway syetem.

As Mr. Wood's work will probably reach another edition, we shall take leave, before parting, to add, for his consideration, a few suggestions for its improvement in a literary point of view. In the first place, we think it might, without any injury to the matter of it, be reduced at least one-third in size, and if also printed in a cheaper form, the number of its readers would be thus multiplied tenfold. Its merit and its bulk are not at all in due proportion. There are many experiments related which, conceived in error, or conducted incorrectly, furnish no certain results, and were, therefore, undeserving of relation; there are others recorded, which subsequent and more complete investigations have rendered no longer of any utility; and there is throughout a great proneness to redundancy and repetition.—In the arrangement of the materials of the book there is also much room for improvement; there is a great show of order and classification, but in reality very little; almost every chapter contains many things which ought to have been transferred to some other chapter. But perhaps the worst of all the faults of the book is the author's excessive fondness for algebraic symbols. The legitimate purpose of such symbols is to simplify calculation; but with Mr. Wood they too often serve only to perplex and mystify—to make something that could have been rendered extremely plain by the help of common arithmetic, impenetrably obscure to the great majority of readers. Mr. Wood should recollect that his treatise professes to be a "practical" one; and unless it be a settled point that it is incompatible with the scientific dignity of a "Colliery Viewer and Member of the Institution of Civil Engineers" to write plain English, he should so alter and amend it that all "practical" men may readily understand it.

◆

RETURN OF THE SILVER COIN FROM THE COLONIES.

Sir,—Considerable surprise has, during the last month, been expressed, at the return of nearly the entire amount of English silver coin, which, since 1819, had been exported to the colonies.

With the single exception of the United Kingdom since 1819, silver is, including one and all of the English colonies, the monetary standard of value throughout the world. Therefore, the United States, without altering the value of one contract, either home or foreign, in the session of Congress just concluded, raised the United States Mint price of the pound of gold to 16 pounds of silver; which is, and has been, the South American Mint price since 1776. The English Mint price is 14·159.

Were, then, a Canadian, West Indian, Gibraltar, or any other English colonial merchant, to exchange 16 pounds of silver for 1 pound of gold, while in the English market he may exchange 14·159 pounds of silver for 1 pound of gold—his friends would, without much exertion of humanity, apply for a Commission, "to inquire whether he were competent to manage his own affairs."

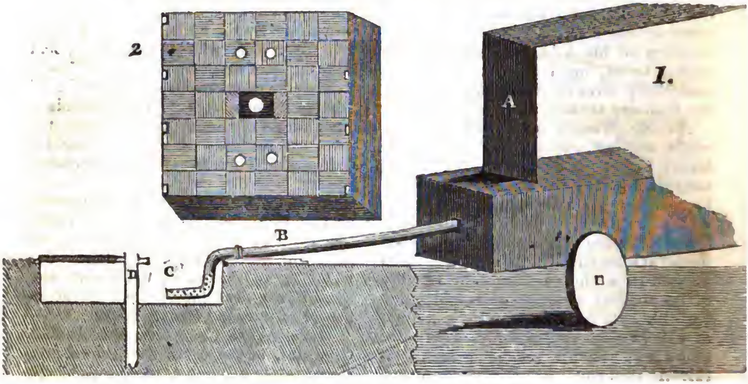
The Quarterly Review says, "we are a nation of very dull book-keepers," (who have kept the books?) The Reviewer is right. The *par* of exchange with China is 83⅓. The East India Company charge but 80—which our economists, to whom the Americans, French, Russians, and Dutch, have abandoned the *science* of adding to "the Wealth of Nations" by the arithmetical rule of substraction, are pleased, (we must charitably suppose in blind ignorance of the *practice* of the remainder of the world) to reduce to 68. The English *bounty* to the rival marine of the United States is 15¼ pence on every Chinese ounce, or tale of silver, at 900 fineness!!! This extraordinary *science* being too profound for the colonists, our former political economists "are repaid in their own coin."

In March, 1830, (last year) the Canadians, without either rent, tithes, or direct taxes, determined the value of the English shilling, with reference to the North and South American price of silver at one shilling and twopence.

The colonists, in rejecting the English currency, have *determined* the fact, that the industrious of the United Kingdom have been compelled to support the *dearest* currency in the world, and, in the same time, to supply the world with the *cheapest* manufactures.

Yours, &c. T.

PLAN FOR ACCELERATING THE SUPPLY OF WATER AT FIRES.



Sir, — Having lately witnessed the breaking out of several calamitous fires, I could not fail to notice the length of time that almost always elapsed, after the arrival of the engines, before they began to play. I observed that this sometimes arose from the absence of the turncock, but more frequently from the time required to form a dam. Nor was the progress made by the flames in the mean while the only thing to be regretted; for when a dam was at length formed, the street pavement had to be broken up for the purpose, and a great deal of loose sand and gravel being thus intermixed with the water, particles of it would insinuate themselves (in spite of patent valves and every other precaution) into the cylinders of the pumps, and, after a time, sometimes stop the engines altogether.

I beg leave to suggest, as a remedy for these evils, the addition of a small cast-iron tank, sunk in the street or pavement above the top of every water pipe of sufficient capacity to contain three or four roses; say 3 feet square and about 8 inches deep. The water-pipe might rise in the centre, and the whole be covered in by a moveable iron plate, which should have a smaller one in the centre, to lift by hand, so as to give the turncock ready access at all times to the pipe. By a trifling bend of the rose pipe at the end of the suction, three or four roses would lie well in the tank, entirely free from every description of filth, and mud, and ready for use, the instant the plates are removed and the water turned on. I send you the accompanying rough sketches to elucidate my suggestion.

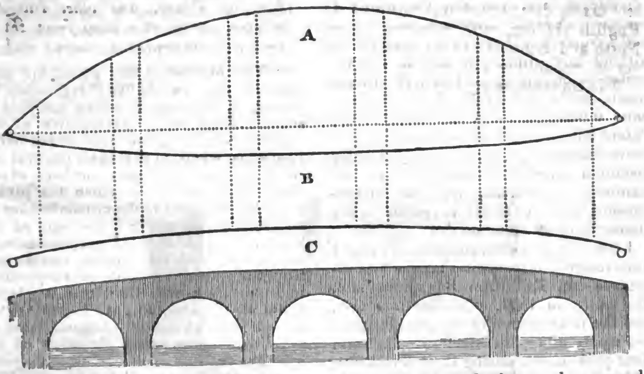
Fig. 1. A represents engine. B the suction-hose. C side-view of the tank half open. D rising main with a small flange rebatted to support the lids, which might be thrown back on hinges by small lifting flush rings.

Fig. 2. represents top of the tank closed and grooved to prevent horses slipping.

Yours, &c.

Phœnix.

ON THE GRADATIONS OF ARCHES.



Sir,—The following inquiry lately arose in my mind:—By what rule are the gradations of the spans of arches as found in bridges determined? I had never heard of any rule for the purpose, (though doubtless better-informed persons could help me to one of old enough standing) and proceeding to speculate on the subject, the accompanying outline suggested itself as one way of answering my question. I drew the theme arch A, which is a quarter of a circle, terminated by the supposed span of a required bridge of five arches; and I perceived, that if I subdivided the arch A *equally* into spaces for arch and pier alternately, that the dotted lines, which fall from their points at right angles with the chord, would mark the widths of arch and pier on the ground-plan of the bridge B, by *regular* diminutions of space, as there shown and repeated in the elevation C. I know not how this plan may contrast with that actually followed for determining the variations on the spans of arches; but it seems to me, with my present knowledge of the subject, to have a very good principle for its basis. Every variety of regular gradation could be expressed by making the original *whole* curve more or less of the half circle, according to the taste of the architect, or to the local circumstances which make one sort of curve preferable to another.

Yours, &c. Riachcraesa.

March 21, 1831.

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BUSBY'S WATER-WHEEL.

Sir,—In the spring of the year 1817, when I arrived in the United States, steam-boats were scarcely known in England; but in America, where the persevering and enterprising spirit of Fulton had succeeded in applying the steam-engine *effectively*, as a first mover, to navigable bodies, steam-boats, on a great scale, were in general use. Coming frequently in contact with the proprietors and constructors of these vessels, I found a very general opinion to prevail among them, that the action of the common paddle-wheel was attended with a considerable loss of power, which, it was conceived, might be avoided if the paddles could be preserved during their passage through the water in a position *parallel to themselves;* this, on reflection, I found might be accomplished in a more simple manner than was commonly supposed, and, accordingly, I constructed a model of a water-wheel, which, though it has not continued to be used, is to this day known by my name in America, and a diagram and description of it, extracted from an American publication of December, 1817, I send herewith for insertion in your valuable miscellany.

I am the more desirous to make this contrivance known among your readers as *my* invention, as I find a patent was taken by Mr. Lambert, of Princes-street, Leicester-square, London, (*to whom I communicated the invention, and sent a model from New York in the year* 1819) without any allusion to me as the inventor—a circumstance I believe to have arisen, on the part of Mr. Lambert, from some misconception of the rules of the Patent-office. And in Nicholson's Operative Mechanic, I, consequently, find *my* invention erroneously attributed to Mr. Lambert, a gentleman who has no pretensions whatever to the invention in the character of an inventor.

I thing it, however, right to say, that I have recently discovered that the late ingenious Mr. Robertson Buchanan had, previously to 1817, published the fact, that the ties connecting the peripheries of two equal and parallel circles maintain their parallelism, during their revolution, with a line passing through their centres; which undoubtedly forms the basis of my invention, but Mr. Buchanan has not applied the principle as I have done. My contrivance completely avoids the force of tension upon every axle; and in action among ice the revolving-ring was found to trundle down the largest pieces, which were immediately chopped into bits by the vertical action of the paddles. My wheel was applied, upon a scale of 12 feet 6 inches diameter, to the York ferry-boat, running between New York and Powles-hook; the effect was greatest when the guard-rollers were so placed as to keep the centre of the ring behind that of the wheel, thus giving the paddles an inclination from the perpendicular, and an *accelerated action against the water*, notwithstanding the uniformity of the revolving motion, as will appear to any one who will take the trouble to make an accurate sketch. With this wheel the York could travel among ice that was found quite impassable with a common paddle-wheel.

Yours, &c. C. A. Busby.

Stanhope-place, Brunswick-terrace,
Brighton, May 23, 1831.

(*Extract from the "American Monthly Magazine and Critical Review," for December*, 1817.)

"*Description of a Water-Wheel recently invented by Mr. C. A. Busby, of New York, Architect and Engineer; applicable to Steam-Boats, Horse-Boats, and Mills, and calculated to avoid the great Loss of Power, and other Inconveniences, heretofore arising from Back-water, Vibration, &c.*

"The paddles of this wheel are perpendicularly bisected and suspended on pivots, by their upper edges, working in sockets fixed in the extremities of the arms of the wheel; the lower edges being re-connected (leaving a small interval between the parts) by braces, or bars, of rod iron. The sockets in which the pivots work are included in the circumference of a circle, whose centre is the axis of the wheel. The paddles are perpendicularly dependant, and the braces equidistant from the respective points of suspension. It is manifest, therefore, that a circle, equal in diameter to that including the sockets, and whose centre should be at as great a distance below the shaft of the wheel as the braces are below the pivots, would pass through all the braces. The inventor has, consequently, been enabled to introduce a strong flat ring in the space (left for that purpose) between the divisions of the paddles, with holes, or sockets, corresponding to those in the arms of the wheel, and through which the braces above-mentioned conveniently pass and work.

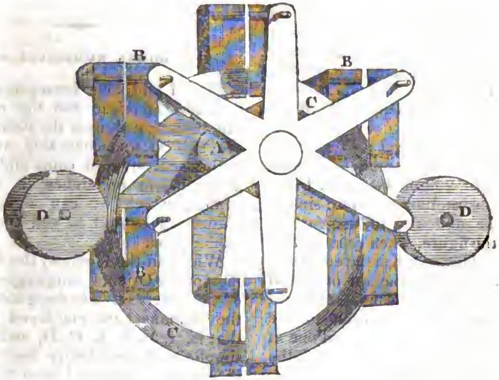
"If the wheel were now put in gentle motion, and met no opposition, the paddles, turning on their pivots, would continue perpendicular; and the ring, suspended by the braces, would revolve about its imaginary axis, at a short distance perpendicularly below the shaft of the wheel. But in case of external resistance, the paddles would trail, or drag, and the ring be carried with them.

"This inconvenience might apparently be obviated by converting the ring into a wheel, and giving to it a fixed axis, or shaft. But then the radii, or spokes, of this second or lower wheel, would be obstructed in action by the shaft of the main wheel, and *vice versa*. It has, therefore, been necessary to adopt some other means of retaining the ring permanently beneath the wheel.

"From an attentive consideration of the construction, so far as already developed, it will be obvious that the ring, independently of its rotary action with the wheel, can only swerve from its appointed station by trailing with the paddles; and this is effectually prevented by the addition of two minor wheels, or guard-rollers, on axes fixed equidistantly from the wheel, level with the centre of the ring, and having their circumferences in contact with the opposite edges of the ring.

" Thus the ring above described, notwithstanding its peculiarities, effectively performs the office of a second wheel, and the paddles, connected with two parallel bicentric circles, and revolving in conjunction with them, firmly maintain their perpendicular directions.

" It may be necessary to add, that this invention, founded on scientific and novel principles, is as remarkable for the simplicity of construction and operation, exemplified in the model, as for the difficulty of conveying an accurate and comprehensive representation of it, through the medium of verbal or graphic description. The following cut, with the explanations accompanying it, will however aid the understanding of the nature of the improvement."



A, axis of the wheel; B, braces passing through the arms of the wheel from which the paddles depend; C, flat ring, connecting the paddles and revolving with them; D, guard-rollers.

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NEWTON'S APPENDIX TO EUCLID'S ELEMENTS.

Sir,—Several months have elapsed since, by my earnest request, you inserted in No. 362 of your valuable work, three problems from Newton's "Appendix to Euclid's Elements." I was very much surprised that these problems should so long remain entirely unnoticed by all of your numerous scientific contributors, whilst to nearly all the problems more recently proposed in your Magazine, solutions have been published. The truth is, that when I stated my difficulty and solicited assistance through the medium of your pages, I flattered myself with the hope, that if I succeeded in obtaining your countenance, I should certainly gain the attention of some of your mathematical contributors; among these, it is very well known, there are some eminent mathematicians—*professors of mathematics*. Great as these are, I presumed that, in this liberal age, when so much has been done, and is still being done, by the learned in behalf of the illiterate thirsters for knowledge, they would condescend to impart instruction to one desirous of obtaining it, and who is destitute of every other resource. To these my insuperable difficulties would appear "trifles light as air," and by a glance of their eye and a dash of their well-practised pens, they could resolve my most complicated perplexities. But I have been disappointed. However, it would be ungrateful not to acknowledge, with thanks, the communications of Mr. Samuel Simple and Kinclaven. The letter of the former certainly contains no solution of my doubts—indeed, Mr. S. seems to be as much puzzled as myself. To his request for a solution of Newton's 6 of I by myself, I am sorry I must reply by stating my utter inability to produce one. When I commenced my studies I spent many evenings in vainly attempting its demonstration; finding I could not succeed, I pursued my course as well as I could through the following propositions, occasionally making attempts upon those I had been unable to surmount in my first reading. Since I have made some proficiency in geometry, I have devoted many hours to the above mentioned proposition; but have never yet been able to establish its truth by means of the few preceding principles: and I perfectly agree with Mr. S. that it contains an anticipation, and if *practicable*, is from its abstruseness improperly placed at the very commencement of the subject.

Kinclaven has advanced no further in the solution of the first problem by principles anterior to 23d of 1st, than I had done in a construction yet more simple than his. The difficulty of the case is, *to prove* that the figure, when constructed, is a SQUARE. This, as Kinclaven justly states, is very easy with the aid of 32d of 1st. With that principle the problem would not present any difficulty even to the merest tyro in geometry. But no one at all acquainted with the nature of the subject *can* admit Kinclaven's construction to be a perfect solution of the problem. The demonstration is an essential part. A square is defined by Euclid—"A four sided figure having all its sides equal, and all its angles right angles." By *Kinclaven's* construction, it is by no means *obvious*, that the quadrilateral he has constructed is equilateral and rectangular. It is, therefore, inconsistent with the rules of geometrical reasoning, to assert that the problem is constructed. His figure cannot be shown to be a square, according to his own statement, without the aid of 32d of 1st. Hence Kinclaven, to whom I beg to tender my thanks for his attempt, has advanced no farther in the solution than had the proposer himself.

For his promised solution of the second problem, I wait with anxiety, being really very desirous of obtaining satisfactory answers to these problems. My only hope is in your pages, from which I and very many others have derived great and important benefits.

Yours, &c.

WILLIAM PEARSE.

Cawsand, Cornwall,
May 6th, 1831.

[It will be satisfactory to Mr. Pearse to learn, that we have lately received very clever solutions of all the three problems alluded to, from a correspondent in Devonshire, who has used Newton's Appendix as a class book for several years, and speaks of it in very high terms. We shall endeavour to find room for them in the course of this month.—ED. M. M.]

THE ROMAN NUMERICAL SYSTEM.

Sir,—I had long been puzzled to understand the origin and the rationale of the numerical signs of the Romans, which are still so unaccountably and provokingly used on most coins and public inscriptions, in preference to the Arabic cypher, which we can all read at a glance. I submit to you the following explanation.

Whilst in the Hebrew, the Greek, and most of the Oriental languages, the whole of the letters serve to designate numbers, the Romans have employed only eight, that is, I, V, X, L, C, D, and M. This simplicity has evidently been the result of a better considered plan than the first spoken of; but simplicity, like other good things, has limits, beyond which it falls into feebleness and inefficiency.

The Romans began by the natural idea of representing unity by a simple vertical stroke I; they marked two unities by II, three unities by III, four unities by IIII, and so on up to nine unities. In many ancient manuscripts, quatuorvir (fourth man) is written, IiiIvir; sevir, or sexvir (sixth man) is written IiiiiIvir.

It would appear, that the Romans, in order to show to the eye that the first corporation of units was complete when they arrived at the tenth, or last vertical line, bethought them of crossing it, which formed the X.

Two tens then became expressed by two X, three tens by X, and so on up to nine X, in like manner as nine unities had been expressed by nine I's.

Arrived at this point, they naturally gave to their letter C, initial of their word *centum*, the faculty of representing the number one hundred, or the tenth ten.

The process was analogously continued in wishing to represent an accumulation of hundreds; they wrote CC for two hundred, CCC for three hundred, CCCC for four hundred, and so on to nine hundred. The tenth hundred, or a thousand, was represented by the sign CIↃ, or by the letter M, initial of the word *Mille*, a thousand.

This system of numerical writing was defective from excess of simplicity. The Romans had began by finding it necessary to relieve the eye from the fatigue and embarrassment of counting vertical strokes all absolutely similar, in the instance above shown, of making the first and the last stroke in IIIvir, and IIIIvir, longer than the intermediate ones. Another improvement followed; in order to represent the half of each corporation of numbers, they thought of adopting a character which was in itself the half of the character which represented the corporation complete. The V was evidently the half of the X; they, therefore, made it represent the fifth unity. The letter C was originally formed thus ⊏; they took the half of this sign, representing a hundred, and so L became the representative of the half hundred, or fifty. In like manner they halved the sign indicative of a thousand, and IↃ, *i. e.* the D, became equivalent to the half thousand, or five hundred.

At length, in order to abridge and condense, as well as to render more clear to ocular perception their numerical expressions, the Romans established that every sign of an inferior value when placed *before*, that is, to the left of another of superior value, should indicate that such inferior amount was to be deducted from the superior; and, on the contrary, that the inferior value was to be added to the superior when the latter was written first. Thus it was, that after having expressed four by IIII, and nine by VIIII, they afterwards expressed them by IV and IX.

It is not in my power to assign the dates to each of the above modifications and improvements in the numerical system of the Romans. But it would not be difficult to prove that they occurred progressively, and at pretty long intervals of time. With respect, however, to the fractional sign D, it would appear that it was not introduced into the Roman system by the Romans themselves, but only about the 15th century, when their language had again become in Europe the language of theologians, of literature, and of the sciences.

The inconvenience of the numerical system of the Romans, for the purposes of arithmetical and mathematical calculation, is too evident to need any remark, except that this inconvenience and unfitness may most likely have been one of the causes which impeded the Romans in their progress in the exact sciences.

Why, at the present day, our eye is to be embarrassed by the additions and subtractions necessary to read the dates and numbers which silly pedantry inscribes upon our monuments, coins, and even books, in the long-winded Roman form, I am at a loss to conceive! Perhaps, Mr. Editor, some of your readers can satisfy in this particular the curiosity of your obedient servant,

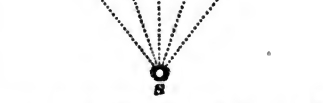
FRANCIS MACERONE.

SOLUTIONS OF QUESTION 1, VOL. XII. P. 13.

" *What curve does the cross of St. Paul's Cathedral, lat.* 51½° *N. describe every twenty-four hours?*"

By MR. UTTING.

Suppose the 24 hours to commence with the civil day at midnight, say at the equinox, the diameter of the Earth to be =7920 miles, and its distance from the Sun 95,000,000 miles; the length of the solar year 36,524,224 days; the altitude of the cross, 340 feet, and its latitude 51½° N., as per question.



Let S represent the Sun, ABCDE a portion of the Earth's orbit described in 24 hours ∴ representing the different positions in the rotary motion of the cross. Hence *a* will represent the situation of the cross at midnight; *b*, its position at 6 o'clock in the morning, or sunrise; *c*, its situation at 12 o'clock, or noon; *d*, its position at 6 o'clock in the afternoon, or sunset; and *e*, its position at midnight, when it will again arrive in a line with the Sun and the Earth's axis. The curves *ab*, *bc*, *cd*, *de*, are semicloidal curves, generated by the orbicular and rotary motions of the Earth. The cross in passing from *a* to *b* has advanced one semidiameter B*b*, of its rotary circle, on the Earth's orbit, in consequence of the direct rotary motion of the Earth. But in moving from *b* towards *c*, a retrogradation takes place in the rotary motion, and when the cross arrives at *c*, it is again in a line with the Sun and Earth's axis. This retrograde motion continues till the cross arrives at *d*, being now retarded by one semidiameter D*d*, whence a direct rotary motion again commences and continues to *e*, when the cross is again in line with the Sun and Earth's axis; a diurnal revolution of the Earth being completed.

Hence from midnight to 6 o'clock in the morning, and from 6 o'clock in the afternoon to midnight, the rotary motion of the cross is direct, and the curves described are equal semicloids. From 6 o'clock in the morning till 6 o'clock in the afternoon, the motion of the cross is retrograde, and the curve described is a cycloid composed of two equal semicloids, generated during the six hours on each side of noon. The length of the exterior cycloidal curves exceeds that of the interior by about 5000 miles; *b* and *a* are points of contrary flexure.

I find, by calculation, that the orbicular motion of the Earth in 24 hours is = 1,634,265 miles. The distance of the cross perpendicular from the Earth's axis or radius of rotation, is 2465 miles, or, more correctly, 13,016,248 feet. The distance of the cross from the plane of the equator 3099 miles.

The curve described by the cross in the above solution is not in the plane of the Earth's orbit, but parallel thereto, and distant therefrom about 3099 miles. The versed sine of the arc BCD is 880 miles, the radius of the circle of rotation of the cross being 2465 miles. The curve *bcd* is, therefore, convex towards the Sun; C*c* being greater than the versed sine, nearly in the proportion of 3 to 1.

If a circle, whose diameter is 518,782 miles, be made to rotate on the circumference of another circle, whose diameter is 189,481,218 miles, and a point be fixed at the distance of 2465 miles from the centre of the rotating circle, that point will generate a series of cycloidal curves precisely similar to those of the cross of St. Paul's. Because the circumference of the generating circle is equal to $\frac{1}{365}$th part of the circumference of the larger circle on which it rotates, consequently any point within the generating circle, and partaking of its rotary motion, would make one revolution in passing from A to E, when it would be again in a line passing through the centres of the two circles. It is hardly necessary to state that the above circles must be placed in a plane parallel to, and distant 3099 miles north of the plane of the equator; the centre of the larger circle being in the axis of the Earth's orbit. The motions of the Earth are too complicated to admit of a rigorous solution to this question, the Earth having a motion round the centre of gravity of the Earth and Moon; and this centre of gravity has also a motion round the centre of gravity of the Sun and planets, whose distances are continually varying from the effects of their mutual perturbations on each other. The inclination of the plane of the curves generated, would also be subject to vary by a quantity equal to the Sun's declination. J. UTTING.

Lynn Regis, May 12, 1831.

By MR. W. D. SNOOKE.

The curve traced out in space by every place on the surface of the Earth, occasioned by the combined effect of the rotation about the axis and the revolution in the orbit, is a succession of *inflected epicycloids*. If the axis were stationary, the radius of the circle traced by St. Paul's would be nearly 2500 miles, but during the rotation the axis advances about 1,632,000 miles; consequently, during half this distance the path traced is *within*, and during the other half *without* the Earth's orbit; the greatest distance in each case being nearly 2500 miles. Now, the *versed sine* of the Earth's orbicular motion in 6 hours is about 900 miles; and since the path traced lies 2500 miles within the orbit, it lies within the versed sine, and is therefore convex towards the Sun at noon. And the same is true for every place whose latitude does not exceed 77°, but for higher latitudes the radius of rotation is less than 900 miles; and, consequently, the traced path is every where concave towards the Sun, similar to that of the Moon. Owing to the inclination of the ecliptic, there would be a slight variation from the above, except at the equinoxes; but as no time of the year is stated in the question, it is perhaps unnecessary to be more particular. We may however observe, that if the orbicular motion in 24 hours were just equal to the circumference of the revolving circle, in this case about 15000 miles, the curve traced would be the true epicycloid, considering the orbit as circular; and if that motion were less than such circumference, the curve traced would be the curtate epicycloid.

W. D. Snooke.

LONDON MECHANICS' INSTITUTION.

On Wednesday, the 1st inst., a Quarterly General Meeting of this Institution was held in the Theatre, Dr. Birkbeck in the Chair.

The Secretary read the Report of the transactions of the last quarter. There had been received 406*l*., expended 347*l*., elaving a balance in hand of 59*l*. Among the receipts were two donations—the usual anonymous one of 30*l*. paid into the bankers, and 10*l*. from a gentleman. Sixty-nine volumes have been added to the Library. The number of members is 941. One honorary member has been elected in right of his donation of 10*l*. New classes have been established for instruction in Mineralogy, Geometry, and Architectural Drawing, (the latter under Mr. Davy). Two members have proffered their gratuitous services in teaching the drawing of the human figure. Mr. Levison will conduct, gratuitously, a Phrenological class. A short-hand class is also to be formed. At the next distribution of prizes, the students of the different schools and classes will exhibit specimens of their improvement in the arts. The following Lectures are to be given in the course of the present quarter. Mr. Thelwall on Elocution (who undertakes a select class of two or three, on condition that they instruct others in the art of elocution.) Mr. Francis on Electricity; Dr. Birkbeck on the Steam-engine; and Basil Montague, Esq. on Jurisprudence.

The Report was unanimously received.

A Member, who begged the Chairman's pardon for addressing him as the subject was personal, called the attention of the Meeting to the large debt of the Institution, attacked the whole body of the members, and rather coarsely proceeded to argue, that with the exception of himself and a select few, they were very dishonest for not having liquidated the debt ere now, and concluded by advising that some specific plan for the purpose should be adopted.

A Member recommended a penny a week subscription, by which, in a way that would scarcely affect the pockets of the members, a considerable reduction of the debt would be effected every year. This suggestion was supported by several members,

Mr. Garvey thought that a good deal might be done by a rigorous system of retrenchment. He objected particularly to the large sum paid for newspapers.

A Member proposed resolving the debt into 25*l*. shares.

Mr. Morris hoped, that any plan which might be determined upon, would be carried into effect under the management of the General Committee.

A Member objected to this; but as the grounds of his objection were not put in a generous spirit, and were evidently founded on some old pique against a defunct committee, we shall not aid his ultroneous purpose by particularizing them. It is strange how fond some persons are of raking up the embers of old dissensions, and raising the ghost of forgotten discords! It is a course that never fails to lead to confusion and turmoil, in the midst of which the real question is usually lost sight of altogether.

Dr. Birkbeck begged to assure the Member who brought the subject of the debt before the meeting, that he did not consider it as at all personal. The Institution had nothing to fear from him—he had no other security for his loan than the honour of the members, in which he would safely confide—nor would they be disturbed, as had been feared, in case of his decease. He had lent the money solely for the purpose of promoting the prosperity of the Institution, and if he did not live to see the sum repaid, he should never feel any discontent or anxiety. He thought they had already done much, much more, indeed, than he could have expected.

After some other routine business, the Meeting adjourned.

We are happy to say, this General Meeting presented, on the whole, a striking and agreeable contrast to the last. There was no confusion, no riot, no boyish boisterousness, no vain attempts to be eloquent. The majority of the members (who are in no way implicated with the raging few) have had the good sense to perceive the necessity of a reform in the character of their proceedings, and by seconding and supporting their excellent President, in his determination to preserve order, they have put a quietus on the evil, and, we hope, for ever.

When a man is in debt he ought to be strictly economical; any indulgence in superfluities is surely a departure from conscientious honesty. This truth may be applied to bodies of men as well as individuals. The Mechanics' Institution now owes a large debt of no less than £3,300. Before the Members indulge themselves in any unnecessary article, that debt should be paid. The sum expended in a year on newspapers is really enormous (£50. 14*s.*!) The appearance of this item in the quarterly account called forth the censure of a very old and zealous Member. We do not wonder at his strictures; the newspapers ought to be given up; at any rate, if extras must find a place in the expenditure, let them be for some truly useful purpose. One would think that the Committee did not know what to do with their money when we find them paying £12. 13*s.* 6*d.* a quarter for news. Let the Members look to this, and deny themselves a petty gratification for the honester purpose of discharging the large sum they are indebted to their generous President. We hope that Mr. Garvey will again call the attention of the Members to this subject; if the Committee do not beforehand act with that spirit which ought to influence all men anxious to pay their way honourably, and at once give up the newspapers.

We think the suggestion of a penny-a-week subscription to pay off the debt ought not to be lost sight of. It would produce, at least, £195 a-year. We hope some Member will take the matter up in right earnest. ☞

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EXPLOSION AT GLASGOW OF ONE OF MR. GURNEY'S STEAM-CARRIAGES.

Mr. Gurney's Steam Carriage was, on Wednesday night blown to pieces by an explosion of the boiler. The catastrophe occurred in the square of the Cavalry Barracks, where the carriage was exhibiting. It had gone round the square several times, and stopped at one corner of it, where some people came out. Two boys at that time entered, and were about to be followed by two gentlemen, when the boiler burst with a tremendous explosion, and shattered the vehicle into numberless pieces. The two boys were very severely injured in the face and other parts of the body, and they now lie in very precarious circumstances. The cause of the explosion has not been satisfactorily ascertained. —*Glasgow Paper.*

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MISCELLANEOUS.

Tortoise-Shell.—At San Blas, on the coast of Darien, a small settlement of Indians is established, for the sole purpose of taking turtle. It is under the management of three English, two American, and three Columbian traders, who make a vast profit from the shell. The quantity of tortoise-shell taken by them amounts, on an average, to 15,000lbs. per year, the value of which is about £28,000. The produce of them varies very much, according to the nature of the season, as in some years they take as much as £32,000 worth of shell, an enormous produce for one out of the many like establishments on this coast. It is a curious fact, that the handsomest shell, and consequently the most valuable, is stripped from the animal while living, the beauty of the shell always becoming less as the animal dies. The dreadful torture which the creature endures by the operation, finds no consideration in the minds of the traders.—*United Service Journal, June*, 1831.

Liverpool and Manchester Railway.—The importance of this work becomes every day more apparent. In the best periods of the coach system of management, 750 or 800 passengers a day was the most that could be conveyed, to and fro, in one day. In the present mode of conveyance by the railway there appears to be no limit to its powers of accommodation. On Wednesday last, upwards of 2000 persons were conveyed, which was considered to be an almost incredible feat; yet this number was exceeded yesterday, for no fewer than 2500 passengers, and 400 tons of goods, passed between both towns.—*Liverpool Mercury, May* 27, 1831.

Rifle-Firing.—A short time before the commencement of the war in the Peninsula, when stationed in Kent with some battalions of the 43rd, 52nd, and 95th Rifle Corps, notes were compared, and the targets of a rifle-company and one of the light infantry were examined, on their return to barracks from practice at the target. The strength of the two companies was equal, being about 80 men each. Six rounds had been fired by every man of both parties; the rifle-company having its target placed at 200 yards (the usual distance), and the light-infantry company at between 80 and 90 yards. The target of the rifle-company was so riddled and cut to pieces, that it was with difficulty brought home; while the target of the light infantry was comparatively in a good state of repair.—*Correspondent of the United Service Journal.*

Heating Copper-Plates by Steam.—Dr. Birkbeck, after the Lecture at the Mechanics' Institution on Friday last, mentioned that he had received a letter from a Member, announcing the gratifying fact, that the hitherto noxious mode of heating the plates in the process of copper-plate printing, had been recently supplanted by the salubrious and equally effectual application of caloric through the medium of steam.

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INTERIM NOTICES.

Communications received from Albert—Mr. Chapman—Curious—Mr. Harvey—W. W. F.—P. H.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

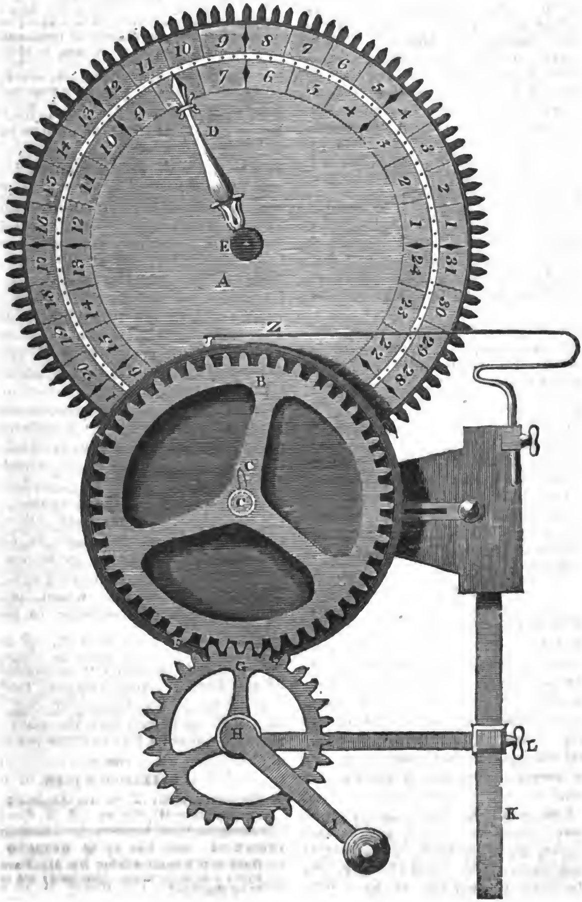
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 410.] SATURDAY, JUNE 18, 1831. [Price 3*d.*

FLIGHT'S MICROMETER FOR SETTING ORGAN MUSIC ON CYLINDERS.



DESCRIPTION OF FLIGHT'S MICROMETER FOR SETTING ORGAN MUSIC ON CYLINDERS.

Communicated by Mr. C. Davy, Architect.

Sir,—To the progress of refinement and luxury, we are indebted for many ingenious contrivances in mechanism, which, though originally intended for the sole gratification of those whose good fortune had placed wealth at their disposal, have proved most extensively useful. Among these the self-acting organ holds a prominent place.

How often has our youthful surprise been excited at the "brazen hieroglyphics," with which the cylinders are studded, and our admiration awakened at the almost magical effects both in time and tone effected by their agency! Many have been the sarcasms levelled at the luxury of ready-made music; but, whatever truth there may be in them, there is so much redeeming merit of a mechanical nature in the self-acting organ, as fully to justify our making it the subject of a special notice in our pages.

As a mechanician, in the line of art which he practises, Mr. Flight has for many years been well known, and it is my object now, to describe an apparatus of his invention, which he very properly calls a Micrometer. It is employed to divide the spaces on the cylinders according to the music, thereby giving the time and duration of the notes represented by the brass pins or staples on the circumference of the barrel; which pins, by raising the levers or keys on the key frame above the barrel, immediately open the communication from the wind chest to the pipes. The apparatus (shown in the drawing full size) is fixed on to the worm, that takes into a toothed wheel on one end of the cylinder, and by turning the handle I, the cylinder is made to revolve. The operator is furnished with a small hammer, with which he slightly strikes the levers or keys, as the cylinder revolves—thus marking the spaces to be occupied by the staples—the score being placed before him.

Description of the Instrument.

A is a dial having 96 teeth on its edge, which 96 parts are marked on the face of the dial, in spaces or compartments of 3 and 4 each, for common and triple time which = 24 compartments for the 4, and 32 for the 3; for, 3 × 32 = 96, and 4 × 24 = 96. The wheel B, is about a $\frac{1}{4}$ inch thick on the edge, and has four small grooves cut on its periphery, for the point of the spring C to run in. These grooves are divided; the first into 4 parts, the second into 3, the third into 6, and the fourth into 8 parts. At each of these divisions, a small hole is drilled for the point of the spring Z to fall into; consequently, if it is put into the first it will divide the circumference of the barrel into 4 parts—if into the second 3, if into the third 6, and if into the fourth 8, which are so many subdivisions of one turn of the dial. This wheel is also furnished at its centre C, with a small pinion of one tooth working into the dial wheel, and moving it every revolution one division, which will be marked by the hand D, fixed to the centre E, on which the dial wheel revolves. F is one of an hundred wheels, the smallest having 20 teeth, and the largest 120. These wheels should be about $\frac{2}{16}$ths of an inch thick, and all made to fit on the centre C of the wheel B, which projects to receive them, and fixed by means of a screw in front. The selection of the number for the wheel, depends on the number of turns of the handle of the organ, for one revolution of the barrel, which is the number of the wheel that must be used. G is one of an hundred wheels, the same as the foregoing, with the exception, that they are $\frac{1}{16}$th of an inch thick, and are made to fit the centre H, on which they are fastened by means of the handle I screwing against it. The selection of this wheel depends upon the time of the music to be set, and the number of 𝅗𝅥, ♩, ♪, &c., &c., that is to occupy the circumference of the barrel. Now, suppose that the handle takes 80 turns for one revolution of the barrel, then the wheel with 80 teeth must be fixed on the centre C; and suppose also, the circumference of the barrel is to take on a piece of music of 20 bars, with 2 𝅗𝅥 in the bar; then the 40 thin wheel must be fixed on the centre H, and the teeth brought into contact with each other, by means of the slide on which the wheel H is fixed, sliding on the triangular bar K, and made fast by the screw L. It will be seen from this arrangement, that the wheel G will be turned round three times for once of the wheel F—that this wheel will carry the other wheel B along with it—that the spring Z, acting in one of the grooves (say the 4th) the circumference will be subdivided into 8 parts, or semiquavers—and that at the end of the revolution, the tooth C will turn the dial-wheel one division, and will be marked by the index D. It will further be observed, that by fixing wheels of different numbers, the circumference of a barrel may be divided into any required number of parts.

Yours, &c. C. DAVY.

The Herschelian, or Companion to the Telescope; consisting of a Series of Projections of Small Zones in the Heavens, containing the Double and Compound Stars, the Nebula and Clusters, from the Catalogues of Sir W. Herschel; and the Stars to the 8th Magnitude inclusive, as laid down in Bodé's Atlas; accompanied by a Set of Tables for each Projection; containing Descriptive Particulars and Extracts relating to Astronomy in general, and the Telescope in particular. By JAMES HOLLAND. Fol. Part I. to be completed in 30 Parts.

The number of publications in this country which go at all into the minutia of siderial astronomy, is so limited, that we hail with delight the prospect of any important addition. The "Herschelian," judging from its title, seems destined to supply an important desideratum; yet an examination of the first Number has shown, that the author must bring to his task an important accession both of materials and industry, before he produces any thing worthy of the approbation of the practical observer. The work is calculated to extend to 30 Numbers; it will, therefore, be a costly one, and the public are entitled to expect that no available materials will be neglected in its formation.

The present Number contains a single plate of the constellations, Orion and Lepus, comprising 28° in right ascension and 47° in declination; the scale 4° to an inch. The stars professedly copied from Bodé's atlas of 1801, with the additions *only* of some of Herschel's double stars, and the *numbers* of his nebula and clusters. The letter-press consists of an introduction, 4 tables of double and compound stars, and of Herschel's and Messier's nebula and clusters, with extracts from Sir William's observations on the mode of observing and classing double stars.

It will scarcely be believed, that of the numerous accessions to our stock of sidereal information during the last 30 years, no use whatever appears to have been made, if we except Sir W. Herschel's small additional list of 145 double stars. The splendid atlas of Harding, containing 50,000 stars, the work of 20 years—the zones of Professor Bessel—and the voluminous researches of the present Mr. Herschel, Sir James South, and Professor Struve—have apparently contributed nothing to the formation of the present work; indeed, we almost doubt whether the author is aware of their existence. He speaks, indeed, in his introduction of Piazzi's catalogue, but he clearly has not made use of it to check Bodé's magnitudes and positions. In proof of this, we need but refer to the star whose right ascension is 79¾, south declination 8½, and Herschel's double stars 1, 52 and 53. And we still have stars inserted, (*e. g.* 26, 63, 76) originally in Flamstead's catalogue, but which have been proved, over and over again, not to have been observed by him, nor ever to have existed.

The disposition of the tables is most defective, since no attempt is made to give the right ascension and declination of the several objects, or even to arrange them in the order of their passing the meridian, which, by common consent of astronomers, is now universally adopted in catalogues of every description.

SOLUTIONS OF PROBLEMS IN NEWTON'S APPENDIX TO EUCLID'S ELEMENTS.

Sir,—In Part 97 of the Mechanic's Magazine is given, by Mr. Utting, a *numerical* solution to a very simple proposition (22, I), in Mr. Isaac Newton's "Appendix to Euclid's Elements and Data." I happen to possess this work, and, on seeing Mr. U.'s solution, it recurred to me, that a few months ago, (vide vol. 12, p. 330, July, 1830,) I had seen two or three other propositions from the same publication, proposed to the consideration of your scientific readers, as involving difficulties insuperable to the proposer, a Mr. Pearse, an unaided mechanic.

As no answers to these propositions have hitherto appeared, and it does not appear that they have attracted the attention of "the able contributors" to your pages, to whom Mr. P. alludes,* I beg the insertion of the following solutions, which I hope will be acceptable to him. But, as prefatory to these, allow me to submit a few remarks on this valuable "Appendix."

On the publication of this little work, about five or six years ago, I adopted it as a class book, and, for my own convenience, drew up solutions to all the exercises on the first six books of the Elements, and to those on the propositions in the eleventh and twelfth, which are usually read at the Universities and public schools. Impressed with the importance of geometrical *analysis* to mathematical students, and pleased with the admirable adaptation to this subject of "the Appendix to the DATA of Euclid," I extended my solutions to the valuable exercises on the Data, and, also, from a conviction of their utility to most of those entitled "Promiscuous Propositions."—Among these last will be found propositions adapted to the various stages of the student's progress through the Elements; but many of them will require the ingenuity and knowledge of the practised geometrician.

In the accomplishment of my undertaking, the propositions were discovered in several instances to have been misplaced. A few are proposed under propositions in the Elements, to which they bear no affinity, and at such stages of the work as preclude the possibility of obtaining legitimate solutions without the aid of principles subsequently unfolded, whilst in other cases exercises are proposed in *advance* of those propositions, from which they are direct deductions; and in some places, the language is not mathematically precise. Had the ingenious author lived to publish a *second* edition, his maturer consideration, and the remarks of the reviewers, would doubtless have induced the removal of these defects.

Those who are engaged in elementary studies, either personally or by superintendence, well know that such inadvertencies are serious obstacles to learners—they are most especially such to those who have not the advantage of a master: I therefore design, at my earliest leisure, to collect and arrange my emendations, and to solicit a corner in your Magazine for their insertion.

As Newton's little work, on many accounts deserves to be popular, in noticing any communication which may tend to bring it into notice, and correct the inaccuracies incidental to a first impression, an important service will be rendered to students in this elementary department of science. The considerations by which this performance comes recommended to the public are, the usefulness and originality of the plan, its comprehensiveness, its cheapness, and, paramount to all, the extensive importance of the subject; for, "that science which compels us to think closely, to reason conclusively, which puts us on our guard against delusion, and is inseparably connected with many of the other sciences, and the most valuable operations in mechanics, is GEOMETRY."

Mr. Pearse's quotation from the author's preface is just. It is *not* enough merely to *read* the writings of the illustrious Greek; something more is wanted to raise the curiosity of the student, and stimulate him to *active* exertion." And these unwrought exercises supply this "something."

In concluding these remarks, allow me to add, that the value of the work would have been greatly enhanced, without increasing the size, had, occasionally, *marginal* references been given to the principal propositions in the Elements, &c., necessary in the solution of the author's more complex deductions.

Answer to Problem 1, *(see Mechanic's Magazine, Vol.* 13, *p.* 330.*)*

The analysis and construction of this problem may be derived without the anticipation of any proposition in the Elements, subsequent to 23 of I, thus:—

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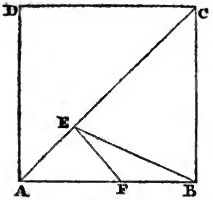
* This letter was written previously to my receiving the xcviii th part of the Mechanic's Magazine, in which is a letter on "Newton's Appendix to Euclid's Elements," subscribed Samuel Simple. It is, however, obvious, that the insertion of that communication in no wise supersedes the admission of this.



Let A B C D be the required square, A C a diagonal, A E the given difference between the side and diagonal; join BE, and draw (11 of I) E F perpendicular to AC. Then, because the angle CEF is equal to the angle CBF, both being right angles (*by construction*) and the angle CEB is equal to the angle CBE, (5 of I) because CE is equal to CB, the remaining angle FEB is equal to the remaining angle FBE, and, therefore, (6 of I) FB is equal to FE. Moreover, (*App. Cor.* 4 of I) the angle EAF is equal to half a right angle, wherefore, in the right-angled triangle EAF, are given AE and the adjacent angles: hence AF and EF are determined; but FB is equal to FE, wherefore, AF and FB or AB is determined; and hence this CONSTRUCTION. On the line A x, indefinite towards x, erect (11 of I) the perpendicular AD, bisect (9 of I) the angle DAB with AE equal to the given difference. Draw EF at right angles to AE, and make (3 of I) FB equal to FE; at B erect the perpendicular BC to cut AE produced in C; make AD equal to AB, and join CD; and ABCD will be the required square. This *appears* evident from the *analysis*, but its complete demonstration depends on 4, 5, and 32 of I.

I should like to know by what "mathematical magic," the proposer has contrived to get safely through Appendix 6 of I, without the aid of ulterior principles, whilst he stumbles at this? I have no hesitation in asserting, that the legitimate demonstration of that theorem is not possible earlier than the 29 of I. It can be more readily deduced from 32 of I, and it is *directly* applicable to the construction of the present problem.

[The continuation, containing the solutions of Problems 2 and 3, in our next.]

NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

(Continued from p. 206.)

TABLE LAMPS. *S. Parlour, Croydon.*—At the top of this lamp there is a reservoir of water, at the base another of oil. A pipe connects the two reservoirs, and the water being heavier than the oil, in the proportion of 10 to 9, gradually displaces the oil, which makes its escape through a separate pipe into the burner. When one supply of oil has been thus exhausted, the water is drawn off, and both reservoirs replenished for a repetition of the process.—*Date of Pat., Dec.* 13, 1830; *of Spec. Feb.* 12, 1831.

STEAM CARRIAGES. *William, George, and Reuben Heaton, Birmingham.*—Messrs. Heaton pretend to no superiority over others, in respect either of economy of fuel or quickness in the generation of steam; neither do they lay claim to novelty in any part of their carriage separately considered; but they profess to have effected such a combination of known contrivances, as makes their carriage better calculated than any other to overcome the inequalities of common roads, and to be employed for speed or power, as circumstances may require. In our last volume, p. 182, there was a letter from a correspondent, giving an account of a very successful exhibition of this carriage, in the streets of Birmingham. It is said to have "started off at an amazing velocity, turning the corners of the streets, right and left, with the greatest exactness." This is certainly more than we remember to have seen recorded of any other steam-carriage.—*Date of Pat., Oct.* 5, 1830; *of Spec. Feb.* 5, 1831.

CERTAIN ADDITIONS TO LOCOMOTIVE-ENGINES. *C. B. Vignoles and John Ericsson, Civil Engineers.*—The patentees propose to obtain by a new method, the same power of ascending inclined planes, which toothed wheels possess on a rack rail. A third or friction rail is to be introduced in the centre of the rail-road, between the two bearing rails; and the engineer is to be enabled, by acting on the long arm of a powerful lever, to cause two horizontal rollers to bear with any degree of pressure, against the sides of this centre-rail—to nip it as it were between them—by which nipping operation, the carriage is to be propelled up the incline. It will be seen, from this brief description, that the improvements specified are not "additions to locomotive engines" merely, but to railways as well. *Date of Pat., Sept.* 7, 1830; *of Spec., March* 7, 1831.

GUARDS OR PROTECTORS FOR HORSES' LEGS AND FEET. *Benjamin Rotch, Esq., Barrister.*—Two or three centuries ago, some pestilent mender of the works of Nature, observed that she had forgotten to give shoes to the horse; and ever since this noble animal has been compelled to go through all the horrors of the smithy-house—to have iron shoes actually nailed to its feet (only suppose, *gentle* reader, the same operation performed on yourself!)—in order to maintain its place in civilized society. Another improver of the same class, has now made the equally sensible discovery, that Nature has also forgotten to provide the animal with stockrings! And never thinking of stockrings, has thought still less of garters!! Both of these extraordinary omissions he proposes to supply, by forthwith providing our equestrian friend with stockings (shorts, it is said, will do) made of that very elastic material caoutchouc; which, if they be only made to fit well, will be sure never to slip down. We presume, that in the march of improvement, horse breeches will come next.—*Date of Pat., March* 20, 1830; *of Spec., March* 18, 1831.

THERMOSTAT, *Andrew Ure, M. D.*—The thermostat is an instrument or apparatus for regulating the opening and shutting of cocks and valves, by a rise and fall of temperature, in the same way as is ordinarily done by the rise and fall of water. It has been suggested by the fact, that different metals possess very different degrees of expansibility. The patentee takes two equal lengths of metal—say zinc and iron—and placing the zinc, the most expansible of the two, uppermost, he rivets them firmly together. Suppose, now, this compound bar to be exposed to an alternation of temperatures, higher and lower than that which it possessed at the time of rivetting; when the temperature is higher, the zinc expands, and gives a considerable downward curvature to the bar; when it is lower, there is an equal curvature in the opposite direction. Suppose, farther, that this bar is connected by a bell-crank with the stop-cock of a vessel which supplies hot water to the chamber containing the thermostat, it is obvious that it will communicate its alternating action to the stop-cock, and enlarge or diminish the aperture of admission accordingly. Dr. Ure thinks that the admission of hot air into a chamber may also be regulated in the same manner. We do not doubt the correctness of the principle on which this instrument is constructed; but it is of too delicate a description to allow us to expect that it will be found to answer so effectually in practice, and on a large scale, as the ingenious patentee supposes. —*Date of Pat., Oct.* 20, 1830; *of Spec., April* 20, 1831.

(To be continued.)

PRINCIPLES OF LOCOMOTION—REPLY OF SAXULA TO B. C.

Sir,—Were I fully to reply to all the remarks of your correspondent B. C., I should occupy too many of your pages. I will briefly notice them in the order they occur in No. 433, page 134.

I acknowledge the reciprocal action of bodies, or force on bodies, the hurling of missiles, and so forth; but the motion of the indefinitely larger body is so small, that in practical discussions it is often considered as nothing; as such I consider it, when I call the earth, water, and air the fulcrums or abutments of locomotion.

I do not admit, that "the fulcrum is determined by the presence of the power." The power may be, and often is present, and moving with the resistance, as in rowing a boat, cracking a nut, cutting clogs and pattens

Whilst the water moved faster than the grounded boat, and the "great globe itself" (if B. C. will have its motion brought in) the fulcrum was in the boat, and the oar a lever of the first class; but the moment the boat moved faster than the water, the fulcrum shifted to the water, and the oar became a lever of the second class, according to our old-fashioned notions of such things, sanctioned by the "authorities;" and Saxula cannot see any but a verbal difference between fulcrum and abutment.

My expression "absolutely moveable," is an ill-defined one; I meant moving, or about to move.

His diagram explained, see page 135, appears to me to be

"Confusion worse confounded."

If Hezron can make any thing correct of it, I am ready to listen, and willing to learn; I will take my share of the "onus." The bowspring has a tendency to force still further apart the points *d* and *i*, by pushing *d* downward and *i* upward; but *d*, by the question, must come upward, to be "perpendicularly over *b*;" now the same point *d* of the lever *a b*, cannot come *upward* and go *downward* the same extent, by the *same force* at the *same time.*

"Egress and regress, *said I well,* Master B."

To be more particular. Suppose the bow-spring expand its whole extent, or say 6 inches, in forcing the point *d* downward, until it be perpendicular to *a c*, when *a c* is *immoveable.* Now, if *a c* is not to lose its horizontal position, as by the question it is not, the point *d* must be forced upward 6 inches, to become perpendicular, or a right angle to *a c*, when *a c* is *moveable*—which appears to involve a contradiction. All that the spring can do, is to force *a c* perpendicular, or a right angle to *a b*, the point *a* remaining in one case stationary, and in the other, nearly so, and this is justified by experiment; *a c* is first an abutment to *a b*, but *a b* cannot be—secondly, an abutment to *a c*, if it must have the same quantum, or 6 inches of motion as before, which the question requires. Did he put a weight on the frame *a c*, as much as the spring could carry?

And how the weights, *m* and *o*, can do any thing but lift the point *c* upward, press the point *d* backward, or rotary round *a*, by the operation of a 3rd class lever, is past my comprehension. That they can lift *a* until it is perpendicular over *b* is, I think, impossible. I may be too dull to understand it, but certainly I do not; perhaps Hezron may. Both weights, *m* and *o*, virtually hang on the point *d*, of the 3rd class lever *a b*, which can *only move backward* by such action. This is the *theory* of the "puzzle for Saxula."

I have tried the "two or three slips of wood pegged to a table," see page 30, and used a bow-spring, page 136, and the result is not as B. C. says it would be; the centre *e* remains nearly stationary; it does not rise to *h*, although it rises a little; the end *c* rises nearly as much as the end *b* fell, page 30, but the point *a* has little or no locomotion, which is the gist of the experiment. I say little or no locomotion, because there is some, created by momentum and a composition of forces not to be touched upon here. I I can give it more or less, according as I release the spring.

I consider the weight, representing power, as being within the machine, and like a spring, an integral part of it, so long as the weight has no other support from the ground but the machine; such is a clock weight, but a horse is not so—he has a support independent of the machine.

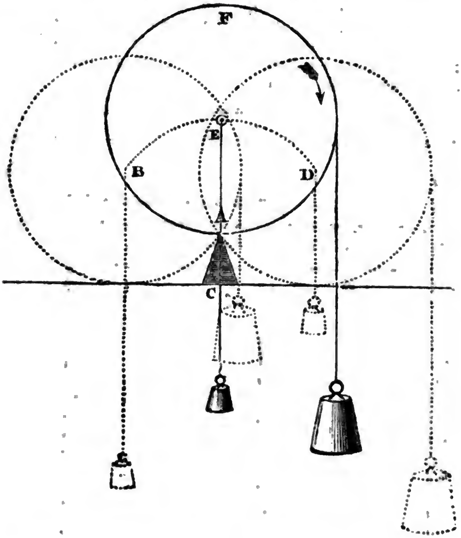
A locomotive force can act, or appear to act, in any direction in any plane; but when it so acts, it must have some measure of its effect, and I say such measure is gravity—I do not say the force is gravity, but that gravity is the measure thereof, and that the line of gravity is the only effective line of direction thereof in locomotive machines. Here the new theory begins.

It is a curious subject, as he says, and worthy investigation: ye "steam carriage projectors," heed him not; foster and water this "germ of a surprising growth," it may be worth your culture—the process is simple. Only—*long levers and weight near the fulcrum*, and not "by making part of the load the direct acting force," as in the wheel-barrow problem—that would be a more complicated process. B. C. would mislead ye; a sly rogue, but I'll watch him. His remarks, page 137, respecting my 5th, 8th, and 9th propositions, being mere opinions, I take no further notice of them.

All the reasoning of B. C. does not convince me that the oar of a boat is a lever of the first order. I adhere to the "authorities," and maintain, that it is a lever of the second order. Is not the quiescent point, or place of least motion, the place of the fulcrum of any lever, whether of the 1st, 2nd, or 3rd order?

Let him look at point *c* in diagram, page 118, and point A in the following diagram, and answer me—and I beg an answer without circumlocution—a plain yes or no, to put an end to the oar discussion. If yes, I desire no more; we can proceed to something else—If no, I must leave it with the Editor to say, whether any courtesy requires me to continue an argument with one who will not acknowledge the established first principles of our creed; we should be like two people arguing about the Christian religion, when one of them does not admit the divine authority of the Bible.

B. C. does not seem to separate the fulcrum of common motion from that of locomotion.



E is the fulcrum of common rotary motion of the wheel BFDA. A is the fulcrum of locomotion, and is a point of the wheel nearly stationary, while the centre E moves from B to D in passing over the obstacle (large or small) C. Before passing the apex of C, the weights act on a lever of the first order, after passing the apex on a lever of the second order. The wheel performs common, though little, rotary motion and locomotion both at one time, and each motion has its separate fulcrum. A bird, in flying, performs reciprocating motion and locomotion both at the same time, and each motion has its separate fulcrum. (This diagram could not be put in practice—the obstacle is too large, the wheel would slip round, and not mount.)

As I have a new and useful object in view, not a bookish recreation, I think it would be only duly courteous in B. C., to examine my theory by the existing mechanical laws, and not perplex it with novel or fine-drawn ideas, however true, when measured by his own new scale. He would lead me into a minute and abstruse disquisition on the science of absolute and relative motions, but I must not be so led; I must reason upon the broad laws of the mechanical powers, as they stand in the authorities; I must stand by them, that they may stand by me. Zachary Fungus, in, I think, one of Foote's plays, called his groom to fence with him, and explained the peculiarities of the art; but the obstinate groom adopted the old well-known cut and thrust system, against which his master's ill-applied science was unavailing, and Zachary was soon brought to a surrender.—Yours, &c.

SAXULA.

P.S. Hezron, page 107, is right in considering locomotive force as a continual tangential force on the wheels, and further, I consider horse tractive force as a reacting tangential force, as far as relates to the periphery of the wheels, which I prove to myself thus. Let the horse and carriage stand still, and let the part of the subplane or tangential force under the wheels be moved backward, the wheels will then turn round; but let the wheels be supported off the plane, and the horse and carriage, now a sledge, moved forward, the wheels will not then go round, although there centres are moved. He is right, too, about the crank; it is a tangential force, acting upon the periphery of an imaginary wheel ever varying in size from a point to its full radius. As to the "rub" in his foot note, can a machine without a lever be constructed? And can any lever act without a fulcrum? Where there is a lever there is a fulcrum.

S.

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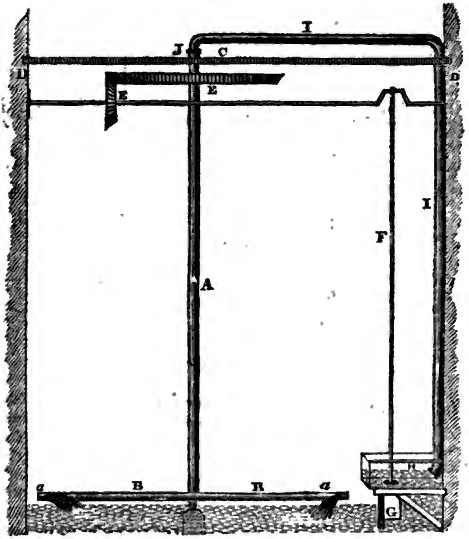
SCHEME OF A HYDRAULIC MOVER, ON THE PRINCIPLE OF BARKER'S MILL.



Sir,—If the above sketch of an Hydraulic Mover, for communicating power to machinery, which I have recently invented, be deemed worthy of a place in your very valuable and useful work, to which I allow myself to be indebted for much information and instruction, I shall feel much pleasure.

A is a hollow cylinder or pipe, forming the upright shaft of a mill on Barker's well-known and effective centrifugal principle.

B B, the lateral pipes from ditto; *a a*, the jets of water, whose centrifugal force gives the motion.

C, beam to support the machinery, built at each end into the wall DD.

E E, two cog-wheels to communicate the motion to

F, the rod of a pump (on Shalder's principle), which derives its supply from the well into which the water from the pipes is conducted, which it raises to

H, a cistern into which one end of a syphon, I I, is introduced, the other end of which is soldered, with an air-tight joint, into the top of the pipe A, to which it thus supplies the water which is continually running from the pipes, BB, producing a constant motion, which may be given by carrying the horizontal rod F, through the wall D, to machinery for any purpose. And if the statement in the pamphlet on Hydrostatics by the Society for Diffusing Useful Knowledge, as to the effect of Barber's Centrifugal Mill, be correct, the power gained must be very great.

The advantages of the invention are obvious. The whole of the machinery for a large factory may be contained under-ground, which indeed will be the most desirable situation for it, and valuable room will thus be saved; the expense of erection will not be great; and the saving in coals, &c., necessary for a steam-engine of the like powers, will be immense. I might, perhaps, have secured much benefit to myself by taking out a patent for the discovery, but I have no wish to profit by monopoly. All I desire is, that it may be recollected that the machine was invented by one who is proud to own himself, Mr. Editor, Your very obedient humble servant, and

A JOURNEYMAN MECHANIC.

London, March 3, 1831.

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ALE FROM MANGEL WURZEL.

Sir,—I am glad to see the subject of brewing from mangel wurzel again taken up in your publication. I tried the experiment last year, and followed, as nearly as I could, the directions of your correspondent at Laceby; but not being at all skilful, my trial was a total failure. But it would give me pleasure to have successful experiments recorded in the Mechanics' Magazine; and I should recommend to your correspondents to be as particular in their information as possible, following in that particular the example of Mr. Cobbett, in his Cottage Economy—to give quantities with the greatest nicety, and also the time that should be given to each stage of the process; in short, let them suppose they are writing to ignorant persons, who want every information, and not speak of things to be done "in the usual way," as Mr. Lester does.

With your permission, I would remark on Mr. Lester's communication, that it would not only be more practicable, but cheaper for a poor man to purchase the roots rather than grow them. Fifteen pounds of roots, he says, are sufficient for a gallon. Now, a bushel of roots, weighing 60lbs. may be bought for 9*d.* often for 6*d.*; therefore, the roots for a gallon would not exceed 2¼*d.*

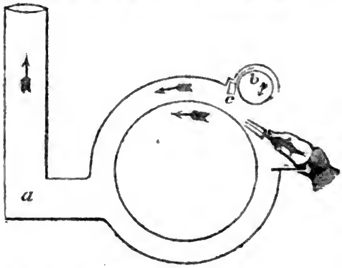
Mr. Lester says, the leaves may be stripped from the plant without retarding the growth in the least. That I deny; I have, by repeated experiments, proved the contrary. The under-leaves may be pulled without much injury; but if the top-leaves are gathered, it is very injurious. Some years ago, the gardener of a gentleman in Essex, or Kent, made repeated trials with the greatest care and accuracy, and the result was printed and distributed through the country; and from those experiments it was most clearly proved, that the stripping the leaves was highly injurious to the growth of the plant.

Yours, &c.

A WELL-WISHER TO THE POOR.

◆

GRINDER'S SAFETY APPARATUS.



Sir,—A drawing, of which the above is a copy, has been in my desk ever since the perusal of an article on the Grinder's Asthma in a Medical Periodical. The principle of the plan here represented, is in part similar to that of your correspondent in No. 392 of the Mechanics' Magazine, which I have just seen.

The drawing exhibits a section of my proposed apparatus.

Heat is supposed to be applied to the flue at the point *a*, in order to produce a draught. The stones might perhaps be set where the heat was required for other purposes.

b is a cylinder of some electric (as sealing-wax or glass) made to revolve by the same power that turns the stone.

c a rubber for exciting the cylinder,

and wiping off the dust it has attracted, in a situation where it may be carried backwards by the current of air.

The case enclosing the stone might communicate with a heated flue; by which I presume a sufficient draught of air would be produced.

It appears to me, that the contrivance might be further improved by the application of electricity, instead of magnetism; viz. by availing ourselves of the same principle, that causes a stick of sealing-wax, when rubbed, to attract small bodies. Perhaps a better plan for this purpose than the one I have described, might be devised—I merely wish to suggest the principle.

Yours, &c. E. DAVY.

March, 1831.

ON THE STUDY OF MATHEMATICS—IN FARTHER REPLY TO "A CONSTANT READER," VOL. XV. P. 32.

Sir,—Presuming that your advice to "A Constant Reader," on mathematics, (whose inquiry, in Part 98, I did not observe till within a few days) was not designed to supersede further suggestions on the subject, I trust I shall not be thought obtrusive, though a humble individual, and, according to vulgar adage, only a *nonus pars hominis*, in offering a few hints to his consideration. I would not be thought to make pretensions to any extensive acquaintance with the science in question; but having succeeded, by my own application and exertions, in making *some* progress therein, I flatter myself, from an experience of the difficulties, discouragements, and pleasures attending the pursuit, I am, in some degree, qualified to lend assistance to others who may be disposed to tread a similar path.

In a course of learning, on any subject, *books* have a primary place, as the means of instruction; but in mathematics, so much they contain wears the appearance of impenetrable mystery and abstruseness that, to a mind soon startled with difficulties, they prove far more repulsive than attractive. In the nature of the case this must, in a considerable degree, be expected: but I make not this statement to alarm the inquirer, but rather to caution him against indulging a false impression, and to prevent him from relinquishing in disgust what might be pursued with success and advantage. Every thing, to a learner of a new science, must, at first, have apparent perplexity; and in mathematics this impediment (if it may be so called) is not of less magnitude than in other subjects; but I think rather more. The student, however, should not allow this to dispirit him; for diligent application will soon render clear, what at first view may seem to be involved in unintelligible confusion. But while I thus endeavour to prepare him to meet this barrier to his progress, I must express my humble opinion, that many mathematical works have much more of the occult character alluded to than is necessary; and that less has been done by way of facilitating the studies of the unaided learner, than his case requires. Indeed, it appears to me that, in most instances, the writers on this subject treat it as if they presupposed the inquirer to possess one-half the knowledge he seeks.[*] The fact is, most of such works are published "for the use of schools," and "Universities;" on which account, the teacher is expected to supply the desideratum of elucidation; a supplement, generally, of no small extent. What, then, is an isolated, plodding, self-instructed to do, under such circumstances, unless he brings to his studies a mind gifted with surpassing powers of conception and comprehension? It is true, there may be books extant professedly designed to suit his exigencies; but how is he to know where to look for them, without information from a friendly monitor? Fortunately for "A Constant Reader," by seeking this direction through the medium of the Mechanics' Magazine, he has, in the advice of the Editor, been furnished with what is so highly requisite to the commencement of his studies. I am not, it is true, acquainted with Dr. Gregory's book; having acquired what knowledge I possess from separate treatises on the different branches of the science: and this plan I should have suggested to the inquirer, had he not been referred to this work, as most likely to answer his purpose. It would, therefore, ill become an individual of such slender pretensions as the writer, to offer any thing as preferable to a recommendation which has all the weight and authority of eminent talent, and scientific skill, to warrant its eligibility.

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[*] Most writers on algebra appear to me to treat the subject as if it were rather a parade of alphabetical mysticism, than a rational system of problematical solution. Hence all the paraphernalia of literal formulæ, "given expressions," &c., by which the learner is often bewildered in a symbolical maze. I reprehend not the use, but the abuse, of this sort of hieroglyphical abstraction. To the adept it, no doubt, presents a convenient summary of analytical and synthetical laws; but to expect that a tyro should trace the *modus operandi* of a complicated numeral process through a medium which has no affinity with the current ideas of calculation, is about as reasonable as that a cabinet-maker should require his appprentice to learn the art of his calling by inspecting prints and models of the articles of furniture, instead of attending for that end to the operations of the work-shop! The *binomial theorem*, in this respect, to a learner, is rather a refinement of intricacy, as to what is called its general formula: but explain it first to him in the common arithmetical language of multiplication and division, and then he will be capable of appreciating the design of the literal mode of representing its rules. The book most free from this objection, that I have seen, (and also, in other respects, preferable) is that of Nicholson and Rowbottom. The Useful Knowledge treatise is not as one should expect, in this particular, from a Society professing to aim at *popular* instruction.

There is, however, one admonition, which, without the charge of presumption, I think I may venture to give as a useful accompaniment to your judicious advice; and which "A Constant Reader" may find worthy his consideration; namely, that *books*, however perspicuously and explicitly written, will not, and must not, be expected to save the trouble of *thinking;* that sort of thinking, I mean, which requires an *effort* of the mind. Indeed, with every advantage as to the means of instruction, little success can be augured without fixed attention and mental exercise; and in order to these, the learner must feel an interest in, and liking for, his studies. There is no such thing as absolute passivity in acquiring knowledge; particularly that under consideration. The mind must be an *active* recipient of propositions and truths, or all tuition, whether oral or not, will be of little service. The schoolboy's memory, by the mechanical routine of learning, may be full of verbal lumber; but his judgment may not be enlightened for want of the mental energy necessary to a perception of the ideas, and the comprehension of the subject. The inquirer, therefore, must not indulge the notion that the best rules, and the most simplified mode of conveying them to the mind, can be thoroughly understood, and carried into operation, without intensity of thought and a determinate spirit of perseverance. He will also find *patience* to be necessary; for the attainment of knowledge is the work of time, and the different steps of the progress must be deliberately proceeded in to be marked with a successful issue. The slower, in reason, are the first stages, the more expeditiously will be the subsequent course. The inquirer, therefore, should not hastily skip from chapter to chapter, and from section to section, but maturely dwell on each successive gradation. He will, no doubt, be often puzzled to comprehend a rule, or master a problem; but let him try again and again, when this is the case, for, by this recurrent practice, light will sometimes break in upon his mind unexpectedly, with great delight and satisfaction. But, above all things, let him not, when difficulties of this kind occur, despair of surmounting them, under a notion that his *capacity* is not equal to the task, as is too often the case. There is certainly a difference amongst men, in this respect. Some have a quicker perception and stronger memory than others; and can, therefore, acquire knowledge with greater care and rapidity: but this is no argument to prove that what is attainable by one mind is beyond the grasp of another. It only shows the necessity of making up the want of such intellectual acuteness by increased attention and persevering energy. It ought to be remembered that a diligent exercise of the mental faculties increases their capability; and habit, with the mind as with the body, will make easy and smooth what indolence would contemplate as irksome and insuperable. In fact, there can be no greater impediment thrown in the way of a person who proposes to himself the study of a science, than a persuasion of incompetency of mind. A moderate share of diffidence is certainly useful in all difficult undertakings; but there is also a measure of self-confidence, which is needful and justifiable to warrant success.

Having thrown out these general hints, I shall just briefly touch on one or two points of particularization. The inquirer will, probably, commence his studies with *algebra*. If so, it may not be amiss to inform him, that if he is not already acquainted with *fractions*, it will be necessary for him to learn them before he can expect to advance. This he can do from any arithmetical guide and key.

The process he may think to be a drudgery; but perhaps it will be more pleasing than he may imagine. Afterwards, in pursuing his algebraic inquiries, let him not be ashamed of the use of his slate; for, if his leisure will allow, he will find it of material benefit in giving him a ready insight into the different parts of the science to work every example given; exemplifying the proverb, that "practice makes perfect."

Finally, let him guard against an ostentatious use of his attainments; for so boundless is the field of investigation before him, that he must, after proceeding a great length, contemplate proficiency as at a distance; and even make some progress before he will discover the *extent* of his own ignorance: for, though it may seem paradoxical, the more he advances in knowledge, the more it will seem he has yet to learn.

Much might be said on the study of mathematics in reply to the *cui bono?* of those sordid minds who can see utility and advantage in nothing that does not contribute to pecuniary prospects or sensual gratification: but having drawn out my remarks, I fear, to a tedious length, this must be declined.

Yours, &c.
A Vulgar Fraction.

◆

NUTT'S BEE-HIVES.

Sir,—I perceive, in your Journal of the 21st May, a request from a correspondent at Bungay to Mr. Massingberd, to explain a letter of his, which appeared in your valuable Magazine on the 28th February, 1830, on my mode of managing bees. Mr. M. is a person of great respectability, a man of genius, and an experienced Apiarian. I regret that he is now on the Continent, and also that he should have referred your readers to me to explain his plans, as they appear in the 341st Number of your Journal; for, though they are represented as being in accordance with my system, this is very far from being the case. I should be wanting both in gratitude and respect to Mr. M. did I ascribe this to any thing else than mistake; I have experienced much kindness at this gentleman's hands, and he has been of great service in spreading a knowledge of the results (this at least) of my Apiarian plans, even to the furthest extent of the globe. Mr. M.'s imperfect information is easily accounted for. When he did me the honour personally to inspect my working Apiary at Moulton Chapel, I was unfortunately from home. Since that period, I have had a correspondence with him, which has doubtless served to rectify his first impressions; but I am well satisfied, that when he transmitted to you his fanciful conjectures on my Apiarian practice, he believed them to be founded on facts, and could not possibly have any intention to mislead your readers; no doubt, he only desired to excite them to inquire after, and adopt, that better mode of managing the honey bee, which I have been successful in introducing.

I am not, at this moment, prepared to answer your Bungay correspondent; but this seems, as regards him, of little consequence, since he expresses such perfect confidence of being master of my system. I must make a remark or two, however, on his assertion, that the bees will produce as much honey and wax in a hive of one shape, as in a hive of another, provided only room enough is given to prevent their swarming; and that if this be done, it matters not whether the hives are placed above, below, or on a level with, each other. I beg to assure him, as well as your readers generally, that there is but one proper shape of the hive, and that attention to this is one of the principal causes of the wonderful increase of produce obtained by my collateral hives, in comparison with the piling or storifying systems of construction. Man cannot make bee seasons, neither can all his art and genius produce the vegetable sweet; still he can do much to facilitate the labours of these extraordinary animals—by regulating, in particular, the temperature of their little houses of industry. I have been asked, by an anonymous friend, Vitious, what the thermometer has to do with bees? He might as well have asked me, what the mainspring of a watch has to do with the regulation of time? Without the mainspring, the watch will not keep time; and without the thermometer, the interior temperature of the hive, on which every thing depends, cannot be adjusted.

I have taken Nature—the bees themselves—for my instructors, in all my apiarian studies; and the more I contemplate the ways of these noble insects, the more I pride myself in bringing to perfection, the economy of their grand commonwealth.

That I have not before now made more fully known to the world the fruits of my inquiries and experience, is owing partly to want of adequate encouragement and support (the common lot of all projectors and improvers), and partly to misfortunes brought on by that inhumanity of man to man, which, as the poet has too truly said, makes "countless thousands mourn." As soon as a sufficient number of subscribers has been added to my list, to defray the expense of publication, and to afford me a reasonable recompense for the time and labour I have bestowed on the subject, I shall disclose all I know. In the meanwhile, permit me, through your medium, to return my grateful thanks to those—not a few—who have already honoured me with their support. And, in the hope, ere long, of giving entire satisfaction, to all my kind patrons and friends,

I remain, Sir, yours, &c.
THOMAS NUTT.

Moulton Chapel, near Spalding, Lincolnshire, May 29, 1831.

We earnestly hope Mr. Nutt will be speedily enabled to bring out his promised publication; on no subject have more numerous or more anxious inquiries been addressed to us, than on his Apiarian system. The subscription price if we recollect rightly, is but 10*s*. To show the importance of the improved mode of treatment which Mr. Nutt has introduced, we subjoin a statement of the produce of a single cottage-hive, during five years that it was under his management, extracted from one of his subscription papers:—

lbs.				lbs.
	First swarm on the	10th June,	1823	
127	Union of the parent stock, -	14th August,	1823	28
132	Collection of honey - - -	12th June,	1824	30
100	- - - - - - - - - - - - - -	16th July,	1825	58
115	- - - - - - - - - - - - - -	10th August,	1826	106
95	- - - - - - - - - - - - - -	10th July,	1827	219
104	- - - - - - - - - - - - - -	6th August,	1828	296
712	For the bees' support during five years.		Contribution	737
737	Contribution.			
1449				

Mr. Nutt adds: "*Not a bee was destroyed.* There is no swarming, no tinkling of the pan. Every day of the gathering season are these indefatigable insects employed for the mutual aid and benefit of the society to which they belong. The first bud of the season and the last flower of the field are visited by these noble insects, if the weather is fine and propitious. They have under this mode of management abundance of room, and are under the same agreeable temperature during the summer gathering."

◆

CURE FOR SQUINTING SUGGESTED.

Sir,—I trust that this communication will be rightly directed to the view of your readers, and that also you will receive it in a proper light, as it is intended to be of service to persons who are apt to look two ways at once, and without being gifted with second sight. Squinting is not always the effect of ocular and defective organization, but too frequently the result of the neglect of those who have the care of infants.

Children squint, either naturally when they bring this misfortune into the world with them, or accidentally from laying in a false light. The light is false, when it glances in upon them at the side; to prevent which, the cradle should always be placed with the feet towards the window in the day time, and opposite to the candle at night, for they are sure always to turn their eyes towards the light. By an ill situation of the bed, the muscles contract an ill habit of drawing the body of the eye unequally.

When this defect is perceived in

children, the use of spectacles should be provided, which serve to direct the eyes and accustom them to look directly on each object, by keeping them on the same parallel line.

These spectacles should be of ebony, and of a concave form, on the side which is placed against the eyes, and pierced with two little eye-holes, which may be either filled with glass or not.

Some parents, perhaps, may smile at this plan; but I would have them recollect, if the object of Vision is at all important, nothing ought to be left untried to assist Nature, or remove the bad consequence of erroneous nursing.

With this impression, Sir, I have hopes you will diffuse an antidote for "squinting," through the useful medium of your scientific and practical work, which may induce a superior intellect than the writer's to further improvement.

Yours, &c. P.

C. C. Acad.

◆

LIGHT FROM LIME.

Sir,—If the little information I am able to communicate respecting "Light from Lime," can be of service to your correspondent An Old Subscriber, vol. 15, p. 192, I shall have a pleasure in thus forwarding it for insertion.

Your correspondent need not trouble himself about giving coherence to lime, in order to form a ball or a cylinder. Let him select at a kiln, a piece of well-burnt lime, and having found this, he will also find it possessed of a sufficient degree of hardness, to admit of being shaped to his purpose, by aid of a pen-knife or a small flat file. Should he not be able to meet with a piece hard enough to bear this treatment, but which crumbles under the action of the tool, he may conclude, that it has absorbed moisture, is become a hydrate of lime, and is unsuited to his purpose. In such case, I would beg your correspondent to select a few pieces of compact carbonate of lime, fashion them into balls (I believe the best form) by means of the file, and then imbed them, surrounded with sand, in a Hessian crucible, and subject this with its contents to a strong furnace heat, during an hour and a half or two hours. In this way he will obtain excellent *lime balls*, which, before they are quite cold, should be put into a dry wide mouth stopper bottle, to secure them from the effects of atmospheric moisture, until wanted for his experiments. Perhaps this method will more certainly ensure success, than trusting to the specimens of imperfect lime he will otherwise obtain.

The hydrogen does not require to be more pure for these experiments, than it is usually evolved from the decomposition of water, by means of sulphuric acid and zinc, or iron turnings; but carburetted hydrogen, in this particular instance, is a very inferior substitute for the gas as commonly prepared. I am happy to assure your Old Subscriber, that he may confidently rely on these few hints, as they are the result of actual experience—the subject being one which has greatly interested my attention, and I will, therefore, take the liberty of adding, that the light from lime "submitted to a flame of hydrogen gas urged by a stream of oxygen," is by no means equal to that which results from exposing the substance to an ignited stream of the gases in a mixed state. The intensity of the light, which thus obtains, baffles description, nor can the strongest eye endure it beyond a glance. I presume your correspondent is aware, that the oxyhydrogen, or mixed gas, requires to be employed under great caution, and burnt by means of a peculiar safety apparatus. I believe I may safely assert, the invention in question has never been adopted in lighting streets, shops, &c., but I am entirely convinced of its admirable applicability to these purposes. An elevated station or two, under proper management, might enlighten a whole town.—Yours, &c.

W. H. WEEKES.

Sandwich, June 1, 1831.

◆

DUTY ON BRICKS.

Sir,—I have noticed with pleasure in your 405th number, some judicious observations respecting the absurd and injurious extra duty of 7s. per 1000 on polished bricks. I was lately informed, through an official channel, that it has been some time in the contemplation of the Government to take off this most impolitic duty. It is clearly *a tax on labour and improvement*, and brings very little in to the revenue. I understand that a bill for its abolition was actually drawn up, at the Excise-office, by order of the Duke of Wellington, and that it would have been brought forward ere this, but for that all-absorbing measure the Reform Bill. I think it would be rendering a *real service to many brick makers*, were you to make this information public, as it may serve as a caution to them, to regulate their stocks accordingly.—Yours, &c.

B. L.

MINOR CORRESPONDENCE.

The Tocsin.—Sir, To remove all doubts, I disclaim being the author of the work you mentioned (p. 208), for the only work of the kind written and published by me, was printed in 1814, but is now out of print. Please to inform your readers of this in your next number, and oblige Your's, &c., ISAAC DUDLEY.

Future State of Intellectualists and Sensualists.—Sir, I remember that, about 15 years ago, I read a book, entitled *Principles of Moral Science, by Robert Forsyth, Esq., Advocate:* wherein the author endeavours to establish certain novel opinions. Mr. Forsyth is a member of the Scotch bar; he promised a second volume, but it has not yet appeared. In the work alluded to, Mr. F. endeavours, by very specious arguments, to establish the doctrine, that persons who have in this life devoted themselves to intellectual pursuits will, after leaving the world, continue to cultivate those branches of knowledge which principally occupied their minds in their mundane state; but that the mere sensualists, finding nothing to do, fall into a kind of stupor, remain dormant for some time, and then become at last eternally extinct. It appears, from one of the papers of your intelligent correspondent, Mr. Utting (in No. 366) that he entertains opinions very analogous to the above.—Yours, &c. A. MACKINNON.

Another Steam-Carriage Candidate.—Sir, Locomotion by steam-carriages is now become a very great and interesting object of pursuit; and I think I may, for one, claim to having studied it well, through that best of all mediums, experience. Saxula states, that by his method he can cause the barrow-wheel to go over a bar, one inch thick, which appears to him a great advancement. Now, I beg to state what I can effect. The carriage I am making my experiments with, is a mere frame upon four wheels; the whole of which may be upwards of half a ton. Well; I can place a bar, four or 5 inches thick, before and *close against* two of the wheels, and with my own power applied to machinery, I can force the carriage, with the two wheels thus situated, *over*] *the bar*. And I am perfectly satisfied, that with good well-finished machinery (for what I have is merely of an experimental description) I could force such a weight over obstacles much greater. I am no mathematical calculator but, like Oliver Evans, I was apprenticed to a wheel-wright (though I do not now follow that trade), and I do presume, that if I had time to spare, and means to boot, I could produce a plan for a locomotive-carriage, capable of doing much more than any I have yet heard of,—Yours, &c. G. M.—*Birmingham, May* 21, 1831.

N. B.—As regards the weight of the carriage, and the obstacles overcome, I have under-rated, rather than over-rated, both.

MISCELLANEOUS.

Stand for a Mercurial Horizon.—Sir, I beg to recommend, for the consideration of persons in the habit of using the mercurial horizon, a contrivance that suggested itself, and was found, from long experience and repeated trials, to be most useful; it having been the means of procuring many observations that might otherwise, from unavoidable obstacles, have been lost. It consists of a piece of lead, nine inches long by seven and a half wide, and half an inch in thickness; having three legs each, about an inch in length, to stand upon. By this means, however uneven the ground, a place will immediately be found for placing it nearly on a level; in soft or sandy soil, also, it forms a firm bed; and the upper part being covered with chamois leather or cloth, entirely prevents any air from affecting the mercury, as well as any dew appearing on the glasses from the effect of the sun's rays over a damp surface, as is too often the case when the cover is placed on the ground.—THOMAS GRAVES, Lieut. R. N.; *United Service Journal for June.*

Pyramids of Teotihualcan.—At a recent meeting of the Royal Geographical Society, a letter was read from Lieutenant Glennie, giving an account of a visit which he had made from Mexico to the Pyramids of Teotihualcan. There is a village of that name, which Lieutenant G. states to be in lat. 19° 42′ N. and long. 98° 51′ E., the variation of the needle being 9° 49′ E. It is elevated 7492 feet above the sea. The pyramids are distant about a mile and a half from the village. The largest is 727 feet square at its base, and 221 feet high, with two of its sides parallel to the meridian. A rampart, of about 30 feet in height, surrounds this pyramid, at the distance of 350 feet from its base; on the north side of which are the remains of a flight of steps, with a road leading from them in a northerly direction, covered with a white cement. The remains of steps were also found on the pyramids, which were covered with the same sort of white cement, as well as broad terraces extending across the sides. The number of pyramids surrounding the large one were estimated by Mr. Glennie at above 200, varying in their dimensions. They are all constructed with volcanic stones and plaster from the adjacent soil. They are coated with white cement, and the ground between their bases seems formerly to have been occupied as streets, being also covered with the same sort of cement. A smaller pyramid than thet above described was covered with a kind of broken pottery, ornamented with various figures and devices; and in the neighbourhood of these edifices abundance of small figures were found, such as heads, arms, legs, &c., moulded in clay, and hardened by fire.

New Motive-Power.—At a recent sitting of the French Academy of Sciences, a letter was read from an individual, who states, that he has discovered a new moving-power, resulting from the combination of two chemical agents with a certain mechanical principle; and that it is applicable to every species of labour, but more particularly to locomotion on common roads.

INTERIM NOTICES.

We have forwarded J. F.'s letter to the author of the Treatise alluded to.

Communications received from J. B—Mr. Smith —Mr. Saul—Mr. Utting—L. E. T.—Mr. Locke—A Welch Tourist.

Errata.—In Mr. Utting's solution of the question respecting the curve described by the Cross of Saint Paul's, p. 238, for "cycloid," "semi-cycloid," &c., read "*epi*cycloid," "semi *epi*cycloid," &c. P. 233, col. 1, l. 11, for "scheme," read "theme."

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, No. 115, Fleet Street; where Communications (post paid) are requested to be addressed.

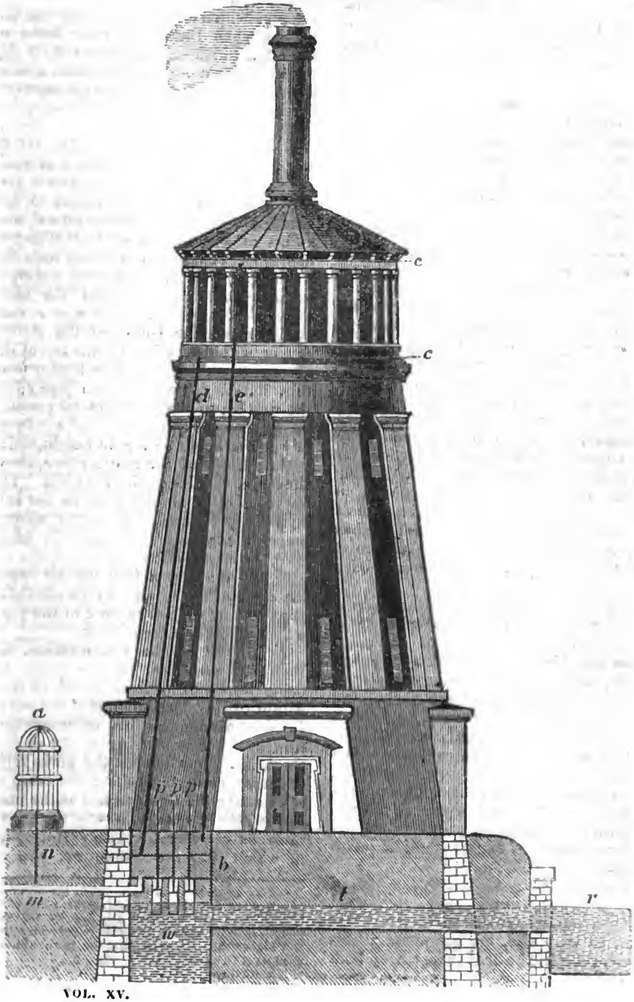
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 411.] SATURDAY, JUNE 25, 1831. [Price 3*d*.

WATER-WORKS AT LYNN-REGIS.



WATERWORKS AT LYNN-REGIS.

Sir,—On reading a paper inserted by your correspondent, Mr. Baddeley, on what he supposes to be a *fallacy in water works*, (Mech. Mag. No. 408, p. 220) I am induced to suppose, that Mr. Baddeley is unacquainted with the nature of the machinery employed for that purpose. The ascending and descending pipes are unconnected with each other, and consequently do not form a syphon; for, what advantage can be derived from forcing the water up one leg of a syphon and down the other? Suppose, for instance, the shorter leg, or that inserted in the reservoir, to be 30 feet in length, and the longer leg, or that connected with the main, to be 40 feet in length—if this syphon is filled with water, there will evidently be a preponderance of 10 feet of water in the longer leg, and the water will acquire a velocity of 7⅓ feet per second nearly. But the same velocity will be obtained, by simply placing the main in the reservoir horizontally; for it is evident, in both cases, that there will be a head of water in the reservoir of 10 feet on the main; I cannot, therefore, see the utility of forcing water up a syphon, on the principle Mr. Baddeley mentions, when it can be propelled by the engine in a horizontal direction, independent of the syphon; for, according to Mr. B.'s statement, there can be no water in reserve, in the tank or cistern at the top of the syphon, for if the pipe has any communication with the cistern at top, the property of the syphon is at once destroyed.

Besides, on the principle of the syphon, no water can be kept in reserve, to be applied in an emergency, in case a fire takes place, when the engine is not at work; unless the water in the reservoir be considerably above the main, and which, as I said before, can be as well effected without the syphon as with it.

If the water in the reservoir which supplies the engine be below the main, the syphon will, of course, be rendered totally useless, and many buildings might, perhaps, in case of fire, be destroyed before the engine could be set to work.

The accompanying sketch is a plan of the water-works in this town, completed last year, under the direction of Mr. Malam, as were also, the gas-works at this place, completed a few years since; both of which, for their efficiency, are I believe equal to any similar works hitherto constructed.

a represents the air vessel; *b* the box in which the pumps work; *c c* the tank, or cistern, at the top of the building; *d* the pipe by which the water is conveyed from the pump-box *b*, to the cistern *c c*; *e* the pipe which returns the water into the well *w*, when the cistern *c c* is full; *m* the main which supplies the town; *n* the pipe which connects the air vessel *a* with the main; *p p p* the pumps; *r* the reservoir from which the engine well *w* is supplied by the tunnel, *t*.

Now, when the engine is first set to work, the water enters the main *m* from the pump-box at *b*, and as the steam gets up, or as the engine approaches to full speed, the water rises in the pipe *d*, and enters the cistern *c c*, which is 8 feet in depth, and contains, when level with the top of the pipe *e*, 60 tons of water, a quantity sufficient to supply the town about half an hour. The pipe *e* rises 7½ feet above the bottom of the cistern *c c*, or within 6 inches of the top of the cistern; when the water rises higher than this, it falls down the return pipe *e* into the well *w*; so that the greatest pressure on the main, is equal to that of a column of water of about 58 feet in height, which is the altitude of the return pipe *e*, above the main, which supplies the town. The air vessel *a*, is of cast iron; its use is to equalize the force of the water when it enters the main; for when the water rises, by any sudden impulse of the engine, up the pipe *n* into the air vessel, the air condenses, and by its elasticity, prevents any sudden rupture in the pipes which might otherwise occur.

In respect to the circumstance, Mr. Baddeley mentions, of the water not being forced to an elevation of 10 feet[*] within two or three furlongs of the works, I cannot account for this, otherwise than that at the first working of the engine, the *branch* pipes nearest the works must, of course, be supplied first; and these for a time take the water as fast as the main can supply it. Or, otherwise the engine must be considerably below full speed, in which case the cistern *c c*, and the principal part of the pipe *d*, will remain empty, and of course little force will be exerted on the water passing through the main.—Yours, &c.

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[*] Two or three years since, when the water was supplied to this town by the old works, some of the branch pipes had not been supplied by the three months together, although they were not above three feet higher than the main, and the town almost a dead level!!!

J. UTTING.

Lynn Regis, June 10th, 1831.

N.B.—In the above sketch of the water-works, I have, for simplicity, represented the water as being pumped into the box at *b*, whereas in the Lynn works, each pump box is connected with the main by a separate pipe.

J. U.

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BURSTING OF WATER-PIPES AFTER FROST.

Sir,—In answer to the question concerning water-pipes, in No. 402 of your very useful work, I beg leave to observe, that it is the expansion of the air contained in the water, when freezing, which causing the bursting of the leaden pipes.

Yours, &c. A. C. F.

April 23, 1831.

Sir,—An "Inquirer after Practical Knowledge," at p. 127 of your present vol. wishes to know the cause of the bursting of lead-pipes after frost. The explanation appears to me to be within the scope of the meanest capacity. I have always considered, that any quantity of water when frozen assumes a much smaller space than it did before congealment took place; so that as fast as the water in the lead-piping becomes frozen, a vacuity is immediately caused, and as immediately filled up by other water from the cistern, or other source of supply. If this opinion be correct, there is, of course, a much larger quantity of water contained in the pipe in a congealed state than it could possibly retain in an uncongealed state. When, therefore, a thaw commences, expansion of the frozen water takes place; and if the pipe were ten times thicker than pipes generally are, its disruption would be inevitable. I beg to subscribe myself,

AN ATTENTIVE READER OF THE MECHANICS' MAGAZINE, AND ANOTHER HUMBLE INQUIRER AFTER PRACTICAL KNOWLEDGE.

Borough, Southwark, April 25, 1831.

Sir,—That pipes should burst, on the freezing of the water contained in them, is but a natural consequence of the peculiar property which water possesses of expanding in bulk as it passes from the liquid to the solid state; but that they should so often burst *after* frost, that is, in the process of thawing, is an effect not so easily to be explained, and I am not surprised that it has suggested the inquiry contained in your 402nd Number. I do not remember to have ever met with any explanation of this phenomenon, and it is with great diffidence I now presume to offer one. To reduce a solid to a fluid state, a great absorption of heat is necessary—in the case of ice, no less than 140°; and every increase in the temperature of a body, causes a corresponding augmentation in its bulk. I conclude, therefore, that the bursting of the pipes, when a thaw takes place, is owing to that augmentation.

Yours, &c. J. PEARCE, M.D.

London, June 1, 1831.

We are by no means satisfied with any of these answers; and hope, therefore, to be excused for adding a few remarks.

The first correspondent, A. C. F. has evidently mistaken the scope of the question; he explains only what takes place at the time of "freezing," and not what happens after the frost has ceased, and while the water is returning to a fluid state.

The "Attentive Reader of the Mechanics' Magazine" displays, with some ingenuity, so great a want of knowledge on the subject, that we apprehend it cannot have been *very long* since he drew water at our well. He says, he has "always considered that any quantity of water when frozen assumes a much smaller space than it did before." Now, the fact, as (we trust) most of the readers of the Mechanics' Magazine are aware, is perfectly the reverse. Water, like all other bodies, contracts by cooling down to the temperature of 40°; but, unlike every other body, it again dilates from that to the freezing-point, 32°, when its expansive force is such, that, according to the calculations of the Florentine Academicians, a globule of water, only one inch in diameter, is capable of overcoming a resistance of more than 27,000lbs. There can, of course, be no such vacuum occasioned by the freezing process as our "Attentive Reader" supposes.

Dr. Pearce exhibits a more familiar

acquaintance with physical science; but his explanation is, to our minds, equally defective. That all bodies are augmented in bulk by an increase of temperature, is a proposition only true when we except from it the very one which is the subject of the present inquiry. We have seen that water in passing into the state of ice is augmented in bulk; and it is a natural consequence of this peculiarity, that in resuming the fluid state, it should resume the same space which it occupied in that state. There cannot be *two* successive expansions of the same body, as Dr. P. supposes—an expansion when freezing, and another expansion when melting. Were this possible, a person would only have to repeat the process often enough to make a pint of water expand into a hogshead. Dr. P.'s explanation, therefore, fails entirely; it rests on an assumption, for which there is no foundation.

We shall not, at present, offer any solution of our own—not desiring to take out of the hands of our correspondents the settlement of a question which seems to us a very fitting one to exercise their ingenuity: but we must take leave to point out a simple matter of fact, which it seems to us very necessary to ascertain, before any serious explanation is thought of. Is it quite certain, that any pipe completely filled with ice, has ever burst from the thawing of that ice? Suppose it were to appear, that such disruptions only take place when the pipe has been partially filled; it is obvious, that such a state of the case must be accounted for on some principle very different from any that has been yet suggested.—EDIT.

PRACTICAL RULE FOR CALCULATING THE POWER OF WATER-WHEELS.

Sir,—In No. 390 of your valuable and interesting publication, one of your correspondents solicits a plain calculation on the power of water-wheels; in order to set at rest the preposterous idea, that the pump, and water-wheel, is an "hydraulic self-mover." "Calculation" *will* clearly and explicitly point out the absurdity of such an idea; I, therefore, transmit the following, in the hope that it it may be thought worthy a corner in your pages.

A few years ago, I laboured to establish a general theorem for ascertaining the power of water-wheels, when, after a tedious investigation into the properties of a revolutionary circle, I found the following to answer in practice very correctly. Multiply ¼ of the buckets in the wheel by the lbs. of water in one bucket, and that by twice the diameter of the wheel into the number of revolutions per minute, which, divided by 33,000, gives the horse-power. One wheel will suffice for example; I shall, therefore, take one of 10 feet, and suppose it to contain 28 buckets, each bucket containing 6. gallons, and that the wheel gives 30 strokes per minute, working with a 1-foot crank, or 2-feet stroke in the working-barrel. First, we have $\frac{28}{4} = 7 \times 60 = 420 \times 20 = 8400 \times 30 = 252{,}000$lbs. lifted 1 foot high per minute, and $\frac{252{,}000}{33{,}000} = 7\frac{2}{3}$ horses. Secondly, to ascertain the weight this wheel is capable of lifting on the crank—we have $1 \times 2 = 2 \times 30 = 60$ feet, the perpendicular lift by each crank per minute, and $\frac{252000}{60} = 4200$lbs. the power of the wheel on the crank, or $\frac{252{,}000}{120} = 2100$lbs. on each crank; $28 \times 6 = 168$ gallons, the quantity of water expended every revolutio Hence $\frac{168}{2} \times 10 = 840$, and $\frac{840}{2} \times 3 = 1260$, and $\sqrt{1260} = 35\frac{1}{2}$ inches nearly, the diameter of the pump. It will, therefore, require 2 pumps of $35\frac{1}{2}$ inches in diameter, giving 2-feet stroke in the pump, to supply the wheel, and make good the powers previously calculated. In order to get this water over the top of the wheel, it must be lifted 10 feet high. Hence $1260 \times 2 = 2520$, and $2520 \times 1680 = 4200$lbs. the weight of water in each pump; consequently, it will require an operating force of 8400lbs. to work both pumps to supply the wheel, whose effective force is only 4200lbs.; and it will, farther, require 2 wheels to supply one of the same dimensions, leaving all friction out of the question. This result is obvious, when we see the operating force moving over the arch of a circle; and when the effective force of the lever is only the cosine of that arch.

WILLIAM TONKIN, Mine-Agent.

Fowey, Cornwall, May 1, 1831.

PRINCIPLES OF LOCOMOTION.

Sir,—From the first appearance of the speculations on locomotion of your correspondent Saxula, *alias* Mr. Clive, (for I find I am not the only person who regards them as *alter et idem*) I have thought that he was labouring under a delusion; but I expected that he would, ere long, find out his error, or that some one more able than myself would succeed in converting him to the true faith (in mechanics). But as this has not been the case hitherto, I beg leave to trouble you with a few very plain hints on the subject.

To follow Saxula through the whole of his argument, seems to me to be quite unnecessary. I will commence nearly where he ends, that is, with diagram No. 5, p. 197; and if I can clearly show that he is wrong in regard to this, the whole of his theory must fall with it. The figure I allude to represents the wheel of a carriage; G the centre of the wheel; B the length of the crank, or a pin projecting at right angles from a spoke of the wheel; C an obstacle upon the road in front of the wheel at, or rather in advance of, a line let fall perpendicularly from the crank-pin B. Saxula says, that no power whatever, pressing or hanging on the crank-pin B, can make the wheel move over the obstacle C. So far I agree with him; I should think the greater the power, the less likely it would be to surmount the obstacle; but I must observe, there is not the least similarity between Saxula's weight p, hanging on the crank-pin B, and the force, as applied by an engine whose motive power is steam. Here is the rock Saxula has split upon; and this I will endeavour to show in as clear and comprehensive a manner as I am able.

If Saxula would apply his right-arm, instead of the dead weight P, to the crank-pin, and press down with whatever force he may, it is no more likely that the wheel would surmount the obstacle C than before; but let him, at the same time, apply his left-hand to the centre of the wheel at G, and press upwards with as much force, or even a less force, then the wheel *will* move over the obstacle, unless it be a very heavy wheel indeed. Now, Sir, this is precisely the principle of locomotion by steam, which I will endeavour to prove by the same figure. Suppose, for a moment, that a cylinder is placed somewhere, with its centre above the crank-pin, and that the piston-rod goes through the bottom of the cylinder, and presses on the crank pin B with a given force. If that cylinder were attached to any other body independent of the carriage of the wheel, it would act precisely as Saxula's weight; but as that is not the case, the cylinder being on the contrary attached to the carriage, and the carriage by the axle to the wheel, it must be obvious that with whatever force the steam presses upon the piston, it will press with equal force against the under side of the cylinder lid, and, consequently, will lift the cylinder, axle, wheel, &c., upwards, at the same time that the piston is pressing the crank-pin downwards; which pressure upwards being acting on a much longer lever, that is, from the line K to the line BP, then from the line BP to the obstacle C, the wheel must surmount the obstacle, if the steam be only strong enough in proportion to the weight it has to move.

I consider, that it is owing to Saxula's totally overlooking this upward pressure, and farther, that the strongest steam neither adds any thing to the actual weight of the machine, &c., nor takes any thing from it (no matter whether the piston is pressing up or down, as it is always counter-balanced), that he has fallen into the errors he has done. Besides, I must say, that I differ from him entirely, when he says that the Theory of Locomotion by Steam is defective as at present employed. The defect appears to me to lie in the enormous weight of the machines, and their necessary appendages, and not in the theory of their application. To lessen that weight is the great desideratum; a great deal has been done in this respect, but more remains to be effected. I do not despair; but hope much from time and practice.

Yours, &c.

GEORGE CHAPMAN.

Whitby, June 6, 1831.

P.S.—I hope, in some future communication, to show you that there is no theoretical advantage, but a very great practical disadvantage, attending long cranks in engines, especially when employed for locomotion.

G. C.

MR. CRAWSHAY'S IRON WORKS AT MERTHYR TYDVIL.

Sir,—The recent disturbances in North Wales have brought fresh to my recollection, an instructive tour which I made through that country a few years ago. I send you some extracts from a book of "Notes" I took on the occasion, relating to the Iron Works of Mr. Crawshay, which you will probably think not undeserving of a place in the pages of the Mechanics' Magazine. They exhibit a picture of human industry on a very large scale; and though, to some persons of narrow minds and envious dispositions, the grand result may seem to be only a great castle with grapes and pines, for one in the million, the true philanthropist will not overlook the comfortable subsistence obtained to thousands through the capital and enterprize of the individual, thus splendidly rewarded, nor the immense addition made by his means to the productive resources of the country.

"*Mr. Crawshay's Iron Works.*

"Number of persons employed 5000.
Annual sum expended for labour, 300,000*l.*
Number of horses employed, 450.
Number of steam engines, 8; each of 50-horse power, but going night and day, doing the work of 12000 horses.
Water-wheels, 8; equal to the power of 654 horses.
Furnaces, 84; each about 50 feet high, and wide in proportion.
Forges, 3.
Foundery, 1.
Rolling Mills, 8.
Boring Mill, 1.

Iron Stone,	Annually used for mixing with the iron ore,	90,000 tons.
Lime,		40,000 tons.
Coals,	annually consumed,	200,000 tons.
Gunpowder,	ditto	80,000 lbs.
Candles,	ditto	120,000 lbs.

"One hundred and twenty miles of tram-railway have been laid down for the use of these works; besides which there is a canal of several miles, with aqueducts, bridges, &c.

"Of tram waggons, made chiefly of iron, there are many thousands.

"Mr. Crawshay has lately built a castle for his own residence, in the vicinity of the works, which covers an area of 174 square feet, and contains 72 apartments. The locks and hinges alone cost 700*l.*

"There is a pinery attached to the castle, which is heated by steam, and costs 850*l.* yearly; an extensive grapery also, that costs nearly as much."

It is worth observing, that whatever may be the case now, the rate of wages at these works, at the time these notes were written, was sufficiently high. The annual sum of 300,000*l.* divided among 5000 persons, gives an average of about 23s. a-head weekly, and that in a cheap country, like Wales, is worth twice as much elsewhere.—Yours, &c.

A WELCH TOURIST.

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SOLUTIONS OF PROBLEMS IN NEWTON'S APPENDIX TO EUCLID'S ELEMENTS.

(Concluded from p. 245).

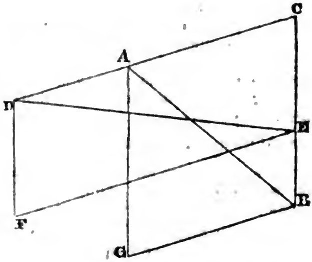
Prob. 2 (Mech. Mag. p. 330, vol. xiii.) To divide the given parallelogram into four triangles by the only modes of solution, suitable to the place of the problem, the sections must be made—1st by diagonals; in which case any two adjacent triangles will be equal to half the parallelogram, (El. 34 of I); or 2d by lines drawn from the extremities of the sides to a point within the parallelogram, in which construction any two opposite triangles, will be equal to half the parallelogram, (*Cresswell's Supplement to Euclid*, 67, 1, *or Bland's Geometrical Problems* 7, 4,): or lastly, by lines drawn from two angles to the opposite side or sides, in which mode of division, either one or two of the triangles will be equivalent to half the parallelogram, according as any one triangle stands on the whole, or each of them on only part, of a side of the parallelogram, (El. 41 of I). Any other quadrisection of the parallelogram into triangles, would involve subsequent properties.

By omitting the word "proportional," the problem will be a direct and very easy application of 10 of 17, under which it is placed, only requiring one of the sides of the parallelogram to be divided in the given ratios; then, by joining the points of division, with either of the opposite angles of the parallelogram, three of the triangles will have the given ratios, (1 of VI.) Or the problem may otherwise be solved, by dividing one side of the parallelogram, in the ratio of the first triangle to the second, and the adjacent side in the ratio of the sum of the first and second to the third; then completing the triangles by joining the points of section, and by drawing lines from the last-determined point to the two opposite angles of the parallelogram. The proof of this also follows from 1 of VI. and an *ex æquo.*

Prob. 3. Since the rectangular and sum, or difference of the sides are given, the sides themselves are easily determined by Lineal Sections, (see the Student, *Probs.* 2 and 6), or as below; and since their included angle is also given, the mode of construction is palpable.

Analysis. — To avoid the trouble of preparing a diagram, let a and b denote the two sides, whose rectangular and sum or difference is given; then (*Cor.* 8 *of* II, *Ingram's or Playfair's Euclid*), $4\,ab + (a-b)^2 = (a+b)^2$; but the rectangular under a and b is given, consequently $4\,a\,b$ is given; and, in one case, $a+b$, and in the other $a-b$ is given—wherefore, in each case, the sum and difference of the sides are given, and thence the sides themselves. The *actual* determination of the sides, and construction of the triangle may be thus described. Find a square (14 of II) equal to four times the given rectangle; let the sides of this be made the base of a right-angled triangle; and the given difference of the sides, the perpendicular, or the given sum the hypothenuse, and complete the right-angled triangle; then will the hypothenuse and perpendicular be respectively equal to the sum and difference of the sides. Now, the semi-difference added to, and taken from the semi-sum, will give the greater and less sides; and placing these lines (23 of I), so as to include an angle equal to the given angle, and joining the opposite extremities, the required triangle will be constructed.

Had the *area* been a datum, instead of the rectangle of the sides, the solution might *naturally* have been deduced from 23 of VI. In having given the rectangle of the sides, and their included angle, we grant the area is likewise given—that is, it may be found geometrically (63 and 2 Euclid's Data); but to deduce a solution, by such a circumduction, is to render complex that which in its nature is essentially simple. With the area, the vertical angle and the sum of difference of the including sides as data, the construction may be thus:



Assume any line CD, given in position and magnitude, and to it apply the parallelogram. CF having its area *double* the given area, and the angle C equal to the given angle (45 of I); determine, as above, the sides CA and CB, having given their sum or difference (hypothenuse), and their rectangle equal to the rectangle under CD and CE; complete the parallelogram, CG, and join AB and DE.

The parallelograms CF and CG are evidently equiangular; they have, therefore, to one another the ratio which is compounded of the ratios of their sides (23 of VI); that is, the ratio which is compounded of the ratios of CA to CD, and, of CB to CE; and (*Construction*) the rectangle under AC and CB, is equal to the rectangle under CD and CE; wherefore (16 of VI.) AC:CD::CE:CB; and, consequently, (*Art.* 597, *under* 16, *VI., Dr. Lardner's Euclid*) the ratio, compounded of the ratios, AC to CD, and of CB to CE, is a ratio of equality; wherefore (A, V) the parallelogram CG, is equal to the parallelogram CF—and, consequently, their halves, the triangles CDE CAB, are equal to each other; but (*Construction*) the parallelogram CF, is equal to double the given area; consequently its half, CDE or CAB, is equal to the given area, and the sum or difference of CA and CB, is equal to the given sum or difference (*ibid*), and the angle C is equal to the given angle; wherefore, ABC is the triangle required.

In the subject of Compound Ratios, Euclid is followed by very few of the modern mathematicians, who have composed Elements of Geometry; in their enunciation of Euclid's 23 of VI., the expression "in the ratio of the rectangles under their containing sides," is preferred to that of Euclid—"in the ratio which is compounded of the ratios of their sides;" and the proposition under the preceding form, is often more convenient in practice, than under the equivalent expression employed by the old Grecian. Bonnycastle has not this proposition in his Elements; but in his 3 of VI., he explains "the compound ratios of the bases and altitudes," to be the same as "the rectangles of those lines," in accordance with the method of the moderns in general.

Leslie (23, IV.), Legendre (24, III), Emerson (18, *Geometrical Proposition*), Reynard (19, V.), and Ozanam (*Schol.* 23, VI.), compound ratios by *multiplication*; but since, as Dr. Simson remarks, "there can be no multiplication but by a number, and there are," as he instances, "some geometrical magnitudes, whose ratios can never be expressed by numbers," this mode of compounding ratios, *in geometry*, appears to be justly liable to objection.

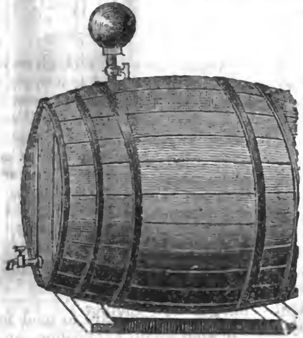
The imperfection here adverted to, is obviated by T. Simpson, in his 11 of IV.; who is followed by Bonnycastle (16, VI.), Young (4, VI.), and Dr. Cresswell (*Supplement to Euclid*, 1, VI.) These writers rigorously demonstrate, that "The rectangles under the corresponding terms of two ranks of proportionals, are themselves proportionals;" using the term rectangle "in precisely the same sense in which it is employed by Euclid, in his first Six Books of the Elements," without even the remotest reference to the *arithmetical* process of multiplication.

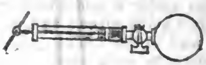
Yours, &c. Σ.

Morice Town, near Devonport,
March 28th, 1831.

DESCRIPTION OF AN IMPROVED MODE OF PRESERVING BEER FROM SOURING.

Invented by Mr. Robert Mallett, Dublin.





A copper ball, of about five inches in diameter, strong enough to bear a considerable pressure, has a cock attached, with a wood screw cut on it, which screws into the hole in the top of the cask, into which the vent-peg is usually put. Previous to attaching this ball to the cask, carbonic acid is injected into it to a pressure of about 50 pounds to the inch (this is easily done by means of a condenser of small bore); it is then to be screwed to the cask. When beer is to be drawn, the cock in the bottom of the cask is opened, and when the beer ceases to run from it the other cock is opened, communicating with the ball, and the carbonic acid gas allowed to press upon the liquid in the cask, which acts much more forcibly than by permitting the atmospheric air to rush in, as has been usually done. The chief advantages to be gained by Mr. Mallett's contrivance are, first, the perfect exclusion of the external air; secondly, portability; and thirdly, the convenience of being able to apply a considerable pressure to impregnate the beer with the gas, as in the manufacture of soda-water.

The whole apparatus may be constructed for the same sum as is usually paid for the patent vent-pegs; and if it did cost something additional, it would be fully repaid in the beer keeping so much longer. Prefixed is a sketch of the apparatus.

R. M.

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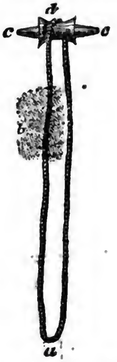
SIMPLE CHIMNEY-CLEANER.



Sir,—At a time when so many improvements are brought forward for bettering the condition of sweeps, you will not, perhaps, deem the accompanying sketch and description of the same unworthy a place in your Magazine.

The method of lowering a rope down a chimney, and employing a man at the top and another at the bottom to drag a brush up and down a chimney with it for the purpose of cleaning it, has suggested an alteration for performing the same operation by the aid of one person only; and perhaps there are only two objections against its use, 1st. that the roof must be ascended for lowering the apparatus, and afterwards for taking it away; and, 2ndly, that it cannot be used where there are mugs: but I shall give it in its most simple and cheapest form (for it would not cost above 7*s.* or 8*s.*) leaving it to your numerous readers to make their own improvements.

The principle of this machine is so simple, that a bare reference to the engraving might almost suffice to explain it. It consists of an endless rope *aa*, with a piece of gorse-bush, or a brush made for the purpose, fastened to it at *b*. This rope is kept from falling down the chimney by the spindle *cc*; and while it sustains the rope, the enlargement in which the groove *d* is cut to receive the rope, keeps it from falling off the chimney-top, while, at the same time, it acts as a wheel, aiding the upward and downward motion of the rope from below.

Yours, &c. E. I****.

Prescot.

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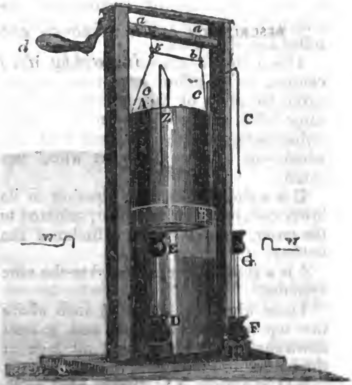
IMPROVED ELECTRO-MAGNETIC BATTERY.



Sir,—I beg leave to send for insertion in your useful publication, an account of an improved Electro-Magnetic Battery, which possesses decided and material advantages over those generally used. Those who have entered upon that highly interesting and important branch of scientific investigation, Electro-Magnetism, will have felt inconvenience and failure of success, arising from loss of time in arranging the various experiments, and adapting the connecting wires, to the respective cups of their batteries, and will be able to appreciate the value of my contrivance.

In ordinary batteries, where the cups are *immediately* attached to the copper and zinc plates or cylinders, the acid must be poured in (or the cylinders immersed in the acid) *before* the connections are made, and in making them, a loss of time will frequently occur, during which the best and most energetic action of the battery is wasting away, the most intense action as is well known, taking place during the very first moments of immersion. This inconvenience is obviated, and other advantages are gained in the battery, which I will now describe.

A B is the usual series of concentric cylinders (mine consists of two copper and two zinc, so connected as to form a simple galvanic arrangement) insulated and kept firmly in their places by small wedges of wood. A brass wire handle of the form represented at *c b b c*, is affixed to the outer cylinder, and the whole is suspended by two small hooks at *b b* to the small chords (whip-cord), by which it is raised or lowered by the roller and winch *a a d*.

This roller should work so stiffly in its centres, as to afford a security to any given elevation of the cylinders—or the same effect secured by means of a counterbalancing weight suspended to the winch—or by a small racket wheel and catch.

C is a stout brass wire, tapering to its lower end, rectangularly bent, soldered to the outer, i. e. the copper cylinder of the battery.

Z is a similar wire, soldered to the zinc cylinder.

These wires rise about 1½ inch above the top of the cylinders, and extend downwards to within about an inch of the bottom of them.

B D is a glass jar (filled as high as E, with the acid mixture) large enough to suffer the cylinders to descend readily into it.

E D and G F are *glass tubes*, of sufficient length and bore to admit the two wires, C and Z, and so placed, that as the cylinder descends, those wires may readily descend into them.

When the battery is about to be used, these tubes are filled with mercury up to the level of the *bottom* of the cups, E and G. Those cups (formed either by a dexterous enlargement of the tube by the blowpipe, or of boxwood and cemented on) must be *large enough to receive the mercury displaced* by the descent of the wires into the tubes.

Herein is the novelty and advantage of my arrangement; all the preliminaries for any experiment may be made, the wires adjusted, and the connections made, by inserting their ends (bent as at W) into the respective cups E and G, *before* the battery is brought into action. When all is ready, the cylinders are lowered into the jar. By the time they are immersed an inch in the acid, the ends of the wires touch the mercury in the battery cups.

Of course the intensity of action will be proportioned (*cæteris paribus*) to the immersion of the cylinders in the acid; its uniformity may, in a great degree, be preserved by gradually lowering the cylinders without disturbing the connecting wires of the experiment, and the action altogether and instantaneously suspended by raising the cylinder above the level of the acid.

Many experiments with the helix, are very conveniently made by placing its ends (each bent as at W) in the cups E and G.

The height of the whole apparatus here represented is about 19 inches, and the diameter of the outer cylinder about 4½ inches—a size sufficient for all purposes.—Yours, &c.

ALBERT.

P.S.—It is certainly foreign to my subject—but I can hardly forego the opportunity (if you will allow it) of recommending to certain of your correspondents *less asperity of tone* and *less personality* in their discussions—and what sometimes strikes me, in reading their communications, less of that perverse determination to misunderstand their opponents, which I think is visible. The cause of Truth and Science is not promoted by such things, and sober-minded inquirers after it are apt to turn away from the essays of angry, supercilious, and captious disputants. Real Science can hardly be thought to choose such for her champions. Let there be the *suaviter in modo* with the *fortiter in re*. Suffer me to add, that it would greatly have enhanced the value of your already valuable publication, if the many pages now disfigured by the things to which I allude, had been occupied by *calm* discussion; and the detail of *facts experimentally proved*, rather than of paper theories. It were *more* allowable in some ephemeral publication, received today and torn up to-morrow; but surely, from volumes designed to occupy a place in the library, and to be referred to in future years, such things should be excluded.

A.

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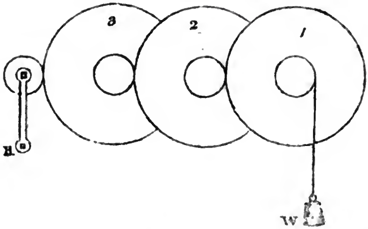
CONSTRUCTION OF CRANES.



Sir,—In looking at cranes for raising great weights, it often occurs to me, that there is a great waste of power and of metal in the ordinary manner of construction. To make this clear, let the accompanying figure represent a train of wheels in a crane, W a weight of 2000lbs. and H the handle. Supposing the small wheels to have ⅕ of the number of teeth on the large wheels, it is plain that the strain at the circumference of No. 1 wheel is 400 lbs.; at the circumference of No. 2, 80 lbs.; of No. 3, 16 lbs.; and at the end of the crane handle, 3⅕ lbs. It is equally plain, that No. 2 wheel need not be near so strong as No. 1, having only ⅕ of the strain; and that No. 3 need not be so strong as No. 2. Yet, in almost all the cranes I have noticed, there is little difference in size between any of the wheels—No. 1 being just as heavy and massive as No. 3, and the crane handle being frequently strong enough to hold the whole weight to be raised. Indeed, the waste of power and want of science here, is sometimes as laughable as the old piers of London Bridge.

From what I have observed above, it will be easily seen, that by adding two more large wheels with pinions to the train delineated before, the power requisite to raise a weight of 2000 lbs. may be produced to 1 oz., so that a watch wheel would be massive enough, and a string or even a thread strong enough, to wind up a hogshead of sugar.

Yours, &c. J. Brown, Jun.

July 12, 1831.

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THE STRAIT OF MAGELLAN — REMARKABLE PECULIARITIES OF CLIMATE.

Captain King, who has been lately employed on a scientific expedition to Patagonia and Terra del Fuego, has communicated to the Royal Geographical Society some singular facts relative to the climate of these regions. The mountains near the middle of the Strait of Magellan are generally about 3000 feet high, and some are as high as 4000 feet. The line of perpetual snow is found to be from 3500 to 4000 feet above the sea. Captain King observed, that those mountains whose height does not exceed 3000 feet are frequently, during the summer, free from snow, excepting in their recesses, where a large quantity is accumulated by drifting and being protected from the effects of the sun. During the summer, when employed at his observatory the greater part of the night, he has found the thermometer as low as the freezing-point, both within and outside of it, and yet, though not warmly clad, he felt no inconvenience from the cold. In the winter time, also, the thermometer has been at 24, without any inconvenience being felt. Captain K. attributes this to the peculiar stilness of the atmosphere on the coast, although at a short distance at sea, in the offing, the wind was high. Another remarkable peculiarity in this climate is the extraordinary warmth of the sea near its surface compared with the state of the atmosphere. In the month of June, a difference of 30 degrees was found between the temperature of each; the consequence of which is, that the sea is covered with a cloud of steam; and this may also, in some measure, account for the prevalence of fogs. A still more singular circumstance is, that parrots and humming-birds, generally the inhabitants of warm regions, are numerous in the southern and western parts of the Strait; they were even observed on the wing during a snow-shower; and after a constant succession of rain, snow, and sleet, the latter have been seen sipping the sweets of the *fuschia*, and other flowers, while the thermometer was at the freezing-point!

MR. WOOLLGAR'S POCKET CALCULATING RULE.

Sir,—I would advise Mr. Woollgar to engage with a mathematical-instrument maker to make a quantity of the 6-inch rules he describes in No. 405; I do not doubt but, from their portability, they would command an extensive sale. I have been in the habit of carrying about me a 12-inch rule for many years, but find it inconvenient. I, therefore, intend to purchase a 6-inch rule, as soon as Mr. W. acquaints me when and where to apply.

I think generally, for surveyors, auctioneers, master-carpenters, &c. the rule would be more convenient if made with a joint, *i. e.* that it should be 12 inches long when open; not to meet at the edges, as the common carpenter's rule, but with two flat surfaces to meet when shut; which would add strength and compactness, and would give room for a table of divisors on one side, and inches and eighths or tenths.

For myself, and others who use a theodolite and sextants, a line of sines and tangents would be very useful at the back of one of the slides, say instead of *k*. But here a difficulty presents itself:—the line *a* being a single radius, the first 6 degrees (which are most used) would not come on the slide, except laid down at twice.

Example. Standing at the foot of a hill, I find by sextant the angle of acclivity to be 2° 52′. Query, the rise of the hill?—Ans. 1 in 20.

If Mr. Woollgar can apply a line of sines and tangents to suit the rule, it will enhance the value of it to myself and others. On one edge I would recommend the foot to be divided into 100 parts.

I have made inquiry after Mr. Woollgar's Companion to the Slide-rule,* but in vain. I hope now soon to obtain a new edition, suited to the 6-inch and other rules.—Yours, &c.

William Andrews.

Ivinghoe, Bucks, June 14, 1831.

P. S.—Since writing the above, I find the difference between the base and hypothenuse so small, as not to be read off on a slide-rule for the first (radius) 5° 42′; so that one line will answer to either sine or tangent up to 5°: which line may occupy the space of *n* on Mr. Bevan's slide. A spare slide of 2 radii, of 3·66′ inches each will, I believe, make the rule very complete. Why cannot a rule with a joint, as I have above described, be made, so as when open, the grooves and slides meet, and pass the joint; and represent Mr. Bevan's, or the Soho rule, sold by Messrs. Jones, Holborn? Such a rule, with Mr. Woollgar's additional lines, would be most valuable.

W. A.

WHEEL WORK—ANSWER TO INQUIRY, VOL. 13, P. 368.

Sir,—On looking over some of your former Magazines, a question on wheel-work from Juvenis, in the last page of No. 364, caught my eye, in which the writer requests information. I have not the least recollection of having seen it before, although I cannot tell how it escaped my observation. Perhaps a reply at this time may be too late to be of service to Juvenis, otherwise I would inform him, that if the two wheels on which the weight or pressure acts, were both equal in diameter, as the one revolves four times oftener than the other, 1¼ lbs. on the rising side of the quickest, or driven wheel, would exactly balance 5 lb., on the descending side of the slowest wheel or first mover. But, as the diameter of the quickest wheel is greater than the other, its circumference must, of course, move through *more than four times the space*, and in direct proportion as it moves through more space, a greater weight will be required on the descending side of the first mover, to cause an equipoise; it being a law in mechanics, that weights, which are inversely as the velocity always balance each other, (and the relative velocities can always be known by the diameters of the wheels, and the ratio of their evolutions). Hence, instead of 5 lbs. 6·0417lbs. will be the true counterpoise; besides which, some additional weight will be required to overcome friction.

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* We have repeatedly mentioned that it was sold by Mr. Elliot, instrument-maker, High Holborn; and, we believe, copies may still be had.—Ed.

The first wheel being either heavy or light, makes no difference to the power—all the difference will be in the friction, which will be somewhat greater as the wheel is heavier.

I cannot answer Juvenis's third question, otherwise than by observing that the most simple machinery is generally the best, and that a ratio of 4:1 may generally be accomplished by a single pair of wheels with the greatest facility; and that the least power is expended on friction, when the size, strength, and weight of the wheels are properly adapted to the work they have to perform.—Yours, &c.

J. H.

Barton-upon-Humber.

Inquiries.

Softening Steel.—Sir, I have often heard it stated, that Mr. Perkins is in possession of the means of making cast-steel considerably softer, without impairing its quality. His softened cast-steel (for the purpose, I believe, of engraving) has been described to be "more ductile than common iron, and capable of being restored (by the ordinary process of hardening) to its original hardness." As I have found some difficulty in working this metal from its impenetrability, (as in cutting screws, &c.) I should be much obliged to some one of your correspondents to tell me, through the medium of the Mechanics' Magazine, how it may be softened. I am not unreasonable enough to request Mr. Perkins's secret; but I wish to know of something more effectual than the common way of annealing. The best way that I know of, is to put the steel, when red-hot, into fine dry coals; this I find to be better than coal-ashes, lime, or chalk; still the result does not come up to my wishes.—Yours respectfully, Y. S. *Poplar.*

[The method of Mr. Perkins has been thus described to us. He lays the steel on a bed of pure iron filings, covers it with another layer of the same material, and encloses the whole in an air-tight cast-iron box. This box is placed in the midst of a strong fire, and kept nearly at a white heat for four hours. The fire is then allowed to go out; so that the box and its contents may cool down gradually, after which the steel is found to have become quite soft—owing, doubtless, to the separation of the carbon which was incorporated with it. The steel-plate may now be as easily engraved upon as one of copper. It was at first thought necessary, after making the engraving, to reharden the steel, to enable it to yield that extraordinary number of impressions, which makes it so superior to all other materials, for the purposes of engraving, and the following was the process which Mr. Perkins followed for this purpose. He put the plate in a box, similar to the one before described, and covered it all over, to the thickness of about an inch, with powdered animal charcoal; the box was then placed in the fire, and kept red hot for between three and five hours, (according to the thickness of the steel); after which it was immediately tempered. But the late Mr. Warren, the engraver, to whom the art of engraving on steel is, perhaps, even more indebted than to Mr. Perkins, ascertained that a decarbonized steel plate is capable, without being hardened, of yielding as great a number of impressions as can be desired in most cases. Mr. Lahee, who has had great experience in printing from steel plates, and is justly celebrated among artists for the beauty of his impressions, informs us, that in one instance an unhardened decarbonized steel plate worked so well, that the artist did not think of taking his own proofs till after *twenty thousand* copies had been struck off. Mr. Warren, in softening the steel, followed the same process as Mr. Perkins; but with this difference, that he employed an intermixture of iron filings and pounded oyster-shells, for his covering, instead of iron-filings alone.—Edit.]

Melting Gold and Silver.—Sir, I am acquainted with a maker of trinkets, who, on all subjects but one, is a most communicative and entertaining person; and that subject is his own little workshop. It contains neither stove nor furnace—neither brazier nor crucible—not even a common fire-place; and yet, without the aid of any of these things, he melts gold and silver, and casts them into trinkets of all shapes and sizes. I have often asked him how he accomplishes this (that he does so, I have ascertained beyond all doubt); but he won't inform me, and says it is a great secret. I told him I would apply to that universal oracle of the curious, the Mechanics' Magazine, for the information I wanted, when he was pleased to say I might do so, and welcome. Perhaps, Sir, you, or some of your readers, may be able to convince my ingenious friend, that the process is not such a "great secret" as he imagines, and by giving publicity to it, you will at once disseminate a very useful piece of information, and exemplify a most important truth, namely, that of all hoarders, the most selfish, and, at the same time, the least secure, is the hoarder of light and knowledge.—Yours, &c. J. L. *Clerkenwell*, *April* 25, 1831.

[Has our correspondent never heard of such things as a lamp and blow-pipe? Jewellers have, we believe, a peculiar mode of using them, and it is in this, the secret (if it be one) must consist.—Edit.]

Net-making, and Mouldy Ink.—Sir, I shall feel much obliged if one of your numerous correspondents will have the kindness to inform me, on one of your useful pages, the correct way to commence a common landing-net, such as are used by anglers to land their fish. In the north of England a net is used of precisely the same kind, but of a much longer size, which is there called a clutching-net, which is used when the rivers are bank-full and muddy. The mode I have always adopted is to net a square piece of any indefinite number of meshes, as 10, 12, 15, 25, &c., as I conceived the size of the net might require, and then to fix a loop in the middle of this square piece and net round it; but in turning the corners of this said square I invariably make a bungling, awkward job of it, so that when the net is finished, the bad workmanship is immediately seen, and looks very ugly. If it is not beneath the aim of your truly valuable Magazine to help a humble lover of knowledge in a case like this, I shall be glad to see the real method of gaining my point set down in it. I shall, likewise, be thankful to any one who will acquaint me with a certain way to prevent ink from moulding; I have tried cloves, and find they are not effectual.—I am, yours, &c. A Constant Reader, *May* 30, 1831.

[A drop or two of oil of lavender prevents moulding effectually.—Edit.]

Flute-makers' Cement.—Sir, Will you have the goodness to spare me a corner in your excellent Magazine for the following inquiry:—With what substance is the leather fixed to flute-keys? Simple though the answer may be, it is matter which has puzzled more than one **Amateur Performer.**

[Probably with the Japanese cement, made of rice-flour. It is with this (mixed sometimes with a little resin), the layers of paper trays and boxes are cemented together. Edit.]

Protection of Copper from Corrosion.—Sir, In your concise and interesting Memoir of Sir Humphrey Davy, there is an account of his discovery of a mode of preserving copper from the action of sea-water. In order to render the copper negative, I presume the iron must be exposed to the action of the water. For instance, if a copper vessel containing sea-water had cast iron soldered outside, would it, then, be preserved from the action of the sea-water? Again, is there any metal that would preserve iron from oxidation in the same circumstances? Zinc is said to do so, but I have great doubts upon the subject. Is there any mode of defending hot iron exposed to a stream of air from oxidation? The solution of these questions will render an essential service to A Constant Reader.

[We do not consider it to be absolutely necessary, that the iron or zinc (for notwithstanding the doubt expressed by our correspondent, the one is as efficient as the other), should be exposed to the direct action of the water, that is, placed in open and immediate contact with it. All that we understand to be requisite is, that an electric current of connection should be established between the iron or zinc and the sea-water; and this, it is obvious, may be effected through any conducting medium. The concluding inquiry of our correspondent, is one that seems well deserving of attention; could it be answered in the affirmative, the practical benefits would be great.—Edit.]

Test for Lead.—Sir,—I have been accustomed to make use of the prussiate of potash, as a test for the spurious introduction of lead into a particular compound; but the other day, after having ascertained by this test that no lead was present—none of the usual white precipitate being produced—I happened, accidentally, to drop some tin filings into the liquid, and shortly after observed a white precipitate at the bottom—exactly the same as would have arisen from lead. I conclude from this, that lead and tin both give with prussiate of potash, a precipitate of the same appearance; and the purpose of my present application, is to know from some of your chemical correspondents, how I am to distinguish between them.—Yours, &c., *A Manufacturer.*—*May* 9, 1831.

Glass Polishing.—Sir, I presume the process of polishing glass is well known in London; but living in the country, I have not an opportunity of seeing it in practice. A description of it in your pages, would I am sure, confer a favour on many more besides, Your obedient Servant, *C. Lawson, Oxford.*

[The art is not so well known even in London as might be expected; if we may judge at least from the number of specimens of bad polishing, with which our philosophical instrument shops abound. As far back as 1787, there was a paper "on casting, grinding, and polishing speculums," by the Rev. John Edwards, published in the Nautical Almanac for that year, which is still considered the best guide that can be followed in regard to these matters. It is rather verbose, and in any shape too long for insertion in this place; but we shall endeavour, at some future opportunity, to republish the substance of it, for the benefit of the inquirer and our readers in general.—Edit.]

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LIST OF NEW PATENTS GRANTED, FROM THE 23rd OF MAY, TO THE 22nd OF JUNE, 1831.

Joshua Proctor Westhead, of Manchester, manufacturer, for his improvements in the manufacture of small wares. Six months, May 23, 1831.

Thomas Knowles, Charlton-row, Lancashire, cotton-spinner, for his improvements in certain machinery, by aid of which machinery, machines, commonly called mules, are, or may be, rendered what is termed self-acting; that is to say, certain improvements in certain machinery, by aid of which machinery, spinning-machines, commonly called mules are, or may be, worked by power without requiring the usual application of strength of the spinners to give motion to the handles or wheels, and to such other parts of mules as are commonly worked by the strength of the spinners. Six months, May 23, 1831.

George Barnard, of Bristol, builder, for his improvements in locks and other spring-fastenings for doors and other places. Six months, May 23, 1831.

Thomas Westrup and William Gibbins, both of Bromley, Middlesex, gentlemen, for their improvements in converting salt or other water into pure or fresh water. Six months, May 24, 1831.

Richard Wood, of New York, in the United States of America, but now of Bishopsgate-street-without, in the City of London (being one of the people called Quakers), for an inking-apparatus, to be used with certain descriptions of printing-presses. Four months, May 24, 1831.

Samuel Hobday, of Birmingham, Warwickshire, steel-snuffer and toy manufacturer, for his improvement in a machine, to be worked by steam, that may be applied for the moving of ships boats and barges on the water; and to carriages, either on the road or tram-ways, and in a fixed position, may be applied to all the purposes that steam-engines are now used for. Six months, May 24, 1831.

Richard Fell, of Fountain-yard, Vauxhall-bridge-road, of Middlesex, plumber, for his improvements in machinery, or apparatus for raising water, and in the application thereof to certain useful purposes. Six months, May 24, 1831.

Nicolas Hegesippe Manicher, of No. 5, Union-road, Southwark, Surrey, chemist, and James Collier, of Canal-grove, New Peckham, Kent, civil engineer, for a new manufacture of useful products from a certain oleaginous substance. Six months, May 31, 1831.

Samuel Lambert, of Regent-street, in the parish of St. James, Westminster, Middlesex, gold-laceman, for an improvement in throstle-spindles for spinning and twisting silk, cotton, wool, flax, and other fibrous substances; communicated by a certain person residing abroad. Three months, June 2, 1831.

Thomas Spinney, of Cheltenham, Gloucestershire, gas-engineer, for his improvements in apparatus for manufacturing gas for illuminations. Two months, June 4, 1831.

John Pearse, of Tavistock, Devonshire, ironmonger, for his improvements on wheeled-carriages, and on apparatus to be used therewith. Six months, June 7, 1831.

Newman Fourdrinier, of Hanley, in the parish of Stoke-upon-Trent, Staffordshire, paper-maker, for a machine for an improved mode of cutting paper. Six months, June 20, 1831.

John Lee Stephens, auctioneer, and Peter Waycott, clock and watch-maker, both of Plymouth, Devonshire, for their improvements in mangles. Six months, June 22, 1831.

New Plan of Obtaining Power from Water.—Sir, I have lately had constructed a small working-model to prove the practicability of a new plan of obtaining power from water, either in places where there is a moderate body and only a slight current, or in situations where there is little water and a considerable fall; but as this kind of work does not come within the range of my mechanical practice, should any wheelwright, or other person, think the discovery of sufficient importance to risk the expense of a patent, I shall be ready to offer every facility for that purpose. I have been more convinced of the value of my discovery, since, in my researches to know whether any thing of the kind had been already done, I have met with the following passage in the Preface to Banks' Treatise on Mills:—"When a man tells me he can construct a water-wheel in such a manner, that when once put in motion it shall raise water to keep itself moving—or that he has constructed a pump in such a manner, that one man may do the work of ten; I pay the same attention to him as if he told me he could create a system of worlds, and command them to move." Though I am equally ready to admit the impossibility of such attempts as these (for the first would be no less than perpetual motion) yet I could convince any person, in the course of a few minutes, were we near a stream of water, that, at a very easy expense, I could return a great portion of the ejected water back into the dam, and thus maintain a considerable increase of power without the aid of pumps, or having the apparatus in any manner connected with the water-wheel.—I am, Sir, yours, &c. GILBERT, *Keighly, May* 23, 1831.

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MISCELLANEOUS.

How to remove a Gold Ring from a Swollen Finger. Take a little quicksilver and rub it upon the ring, which will soon be penetrated by it, and become so brittle, that it will break easily.

Corn Brandy.—A German chemist states, that if a small quantity of oxymuriate of lime, moistened with water, be added to the wash before distilling, the taste peculiar to all corn brandies will be completely removed.

Titanium, though indebted for its name and its place among the metals, to Klaproth, was first observed by a Mr. Gregor, in the valley of Menachon, in Cornwall, in 1791, who proposed to call it after the place of its discovery, *Menachine*.—W. T.

Gurney's Steam Carriage.—Mr. Gurney has written a letter to the newspapers, respecting the late accident at Glasgow, in which he says:—"In March last, a steam-carriage on my principle was sent by sea to Edinburgh, and so much injured in the freight, that after one experiment from hence to Glasgow, I left Scotland and returned to London. The carriage was packed up by the engineer, to await my decision, namely, whether it should be repaired in Scotland, or sent back to London. He immediately followed, and stated that he had, with a view to prevent any wanton or unjust use of the carriage in his absence, taken off several important parts of the machinery, particularly some connected with the safety-valve. Since that time I have been in Cornwall, and now learn, with sincere regret, that in violation of every feeling of justice, instead of the carriage being sent back to London, attempts have been made to substitute or repair the deficiencies, and unwarrantable experiments made with it by persons totally unacquainted with the principle, in opposition to my wishes, and even without my knowledge." Mr. Gurney adds: "I have, at great personal sacrifice, subjected the apparatus, during the last five years, to every trial and experimental test. The carriage at Gloucester has been running daily as a public stage, for the last four months uninterrupted, and has taken upwards of 3000 passengers without a single personal accident. And I boldly assert, that with a carriage built on my principle, and an engineer at all acquainted with it, no such accident as that stated to have happened at Glasgow, could possibly have occurred."

Norwich made a Sea-port.—A communication has been opened between the sea and Lake Lothing, below Norwich, by which means this ancient city is now become a sea-port. On the 3rd of June, the first vessel (the Ruby, a yacht of 50 tons) entered the lake through the lock from the sea. Some very striking circumstances attended the admission of the sea water. The salt water forced itself in a distinct and separate stream under the fresh water, heaving the latter upwards as it proceeded, and at length occupying exclusively the whole of the bottom of the lake. At a short distance from the lock in the lake, there was a clearly defined line where the salt water might be taken up in one hand, and the fresh in the other. The admission of the sea water proved fatal to thousands of the inhabitants of the lake, and its surface was seen covered with dead pike, carp, perch, bream, roach, and dace.

Quick Steam Passage.—On Saturday last (12th June) the new steamer, the *Wellington*, of Dover, left for Boulogne, which place she reached, landed her passengers and baggage, remaining in port for that purpose 40 minutes; and then returned to Dover harbour the same tide. The whole occupied about seven hours, being a feat that has never been performed between these ports since the introduction of steam navigation.—*Kentish Chronicle.*

Origin of Printing.—Cicero, in his *De Naturâ Deorum*, has a passage from which Toland supposes the moderns took the hint of printing. He speaks of types made of metal, and calls them *formæ literarum*, the very words used by the first printers to designate them. He gives a hint, too, of separate cast letters when he talks of "some ingenious" man's throwing the twenty-four letters of the alphabet together by chance, and thus producing the Annals of Ennius.

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INTERIM NOTICES.

Communications received from Mr. Baddeley—Henry D.—☞—Mr. Locke—Mr. P. B. Clegg—Dios—A Reader at Newark—Tenby.

☞ *Our Readers and Correspondents are particularly requested to take notice, that the Office of the Magazine is removed to Wine-Office court, Fleet Street; to which all Communications for the Editor, or Orders for the Publisher, are requested to be in future addressed.*

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-Office-court, Fleet Street.

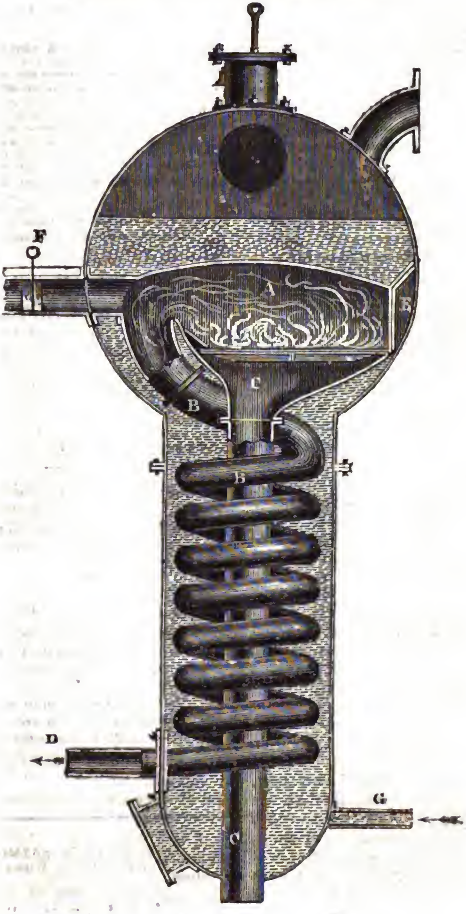
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 412.] SATURDAY, JULY 2, 1831. [Price 3*d*.

GIBBS' PATENT STEAM-BOILER.



GIBBS' PATENT STEAM-BOILER.

Among the patents granted in November last (see Mechanics' Magazine, vol xiv. p. 477) was one to "J. Gibbs, of Crayford, Kent, Esq., for improvements in evaporating fluids, applicable to various purposes." The specification, which was lodged on the 6th of May last, describes various modes in which the patentee's supposed "improvements" may be carried into practical effect, and each mode is illustrated by a separate engraving; but as one principle pervades all the arrangements, we have selected that which is represented, on the preceding page, as being on the whole the best fitted to convey a clear notion of the said principle to our readers.

The engraving exhibits a sectional view of a steam-boiler on Mr. Gibb's plan. A is the furnace in the heart of the boiler, with water above, below, and all around it; E is a door for supplying the furnace with fuel; B B is a flue which proceeds from the furnace, downwards, in a spiral form, through the water, and is then turned aside into the chimney D; C is a pipe which passes from the bottom of the apparatus up through the spiral flue, into the furnace; and by this pipe air is to be supplied to the fire in any way, and to any extent that may be found in practice most expedient; F is a damper to an occasional flue, through which the smoke is permitted to pass at the first getting up of the fire; and G is the pipe by which the boiler is supplied with water. The other parts of the apparatus require no explanation.

The "improvements" which Mr. Gibbs conceives he has realized, appear to consist, 1. In carrying the flue of the furnace by a long circuitous course through the water, so that the heated air may part with a more than common portion of its caloric before escaping into the atmosphere. And, 2nd. In turning the flue more directly downwards than has been ever heretofore done.

We hope, for Mr. Gibbs' own sake, that he sees his way clearly through the great number of conflicting patents which a claim to such improvements as these, must at once bring to the recollection of every well-informed reader. We have had flues prolonged before in almost every possible way; whether in so directly downward a direction as that preferred by Mr. Gibbs, we cannot at present say, but *downward*, certainly, to an extent quite sufficient to put this gentleman's claim to the *perpendicular downwards*, in serious jeopardy.

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BREAKWATER PORTLAND ROADS.

Sir, — Since my last communication respecting the Breakwater for Portland Roads, I have adventitiously, as well as by my own research, obtained a great deal of additional information on the subject, which, I think you will agree with me in opinion, is well deserving the notice of the public. With that impresssion, I send you herewith, a copy of another letter I have received from Captain Bennett, who feels as an Englishman should feel, on a matter so intimately connected with our national welfare; and also those gleanings of my own, to which I have above alluded; the whole for insertion in your extensively circulated, and deservedly esteemed publication, the Mechanics' Magazine. The details are so full, that nothing further is required from me, than to express my thanks for your former attention, the continuance of which I now solicit—And am,

Dear Sir, yours truly,
JOHN HARVEY.

Weymouth, June 7, 1831.

Second Letter from Captain Joseph Bennett, late commanding one of his Majesty's Packets upon the Weymouth Station. To Mr. John Harvey, of Weymouth, (dated, May 21, 1831.

Dear Sir,

The unsettled state of the Continent—the certainty that *a new dock is to be opened at Cherbourg during the present year*, and that the Breakwater at Plymouth is about to be completed, added to the undisputed necessity, that an efficient Naval and Mercantile Rendezvous, should be established between Portsmouth and Plymouth, form together a combination of occurrences, as eventful as they are pregnant with important consequences.

I feel anxious on so momentous a subject, and again address you; presuming that the suggestions resulting from an experience of seventy years active channel service, may be thought at least worthy of some attention, being alike disinterested and gratuitous.

I own I am more and more impressed with a conviction, that there is nothing of such vital importance to the welfare of *British commerce in general*, and the *British navy in particular*, than the establishment of a BREAKWATER FOR PORTLAND ROADS. In the hope of contributing in some degree to draw public attention to the project, and of obtaining for it that serious consideration which it demands, I have committed to writing, the following remarks; which have this at least to recommend them, that they have practical experience for their foundation, matured by repeated confirmatory observations, all tending to strengthen the propriety and fitness, nay, I may truly add, the *necessity*, of appropriating the *natural resources*,* so easily attainable, to the progressive completion of this great design.

Suppose we are again plunged into a war, and that there is a French fleet of any given force, fully equipped, lying at Cherbourg, anxious to put to sea, but that for months after war is declared, it dare not venture out in face of an English fleet of equal force, say 12 sail of the line and 6 frigates, ready to give them the smell of English powder, and the effect of English shot;—well, during the blockade, the French would most probably, under favour of adventitious circumstances, increase their force to 15 sail of the line and 10 frigates, manned with additional hands, elevated with the pleasing anticipation of insuring a victory, by taking the greater part of the English fleet and crippling the remainder, before a reinforcement could be obtained.

The combined fleets of France and Spain in Cadiz Bay, in the year 1805, produce a case in point.

"The French having joined the Spanish (and embarked 4,000 troops on board the fleets, among whom were several of the most skilful sharp-shooters that could be selected; and many Tyrolese riflemen, thus equipped, and being so numerous) they ventured to sea, and it will be recollected that Nelson attacked them off Trafalgar, on the 21st of October in the same year. The British fleet consisted of 27 sail of the line, and 4 frigates. The enemy of 33 sail of the line, and 7 large frigates, and their superiority was greater in size and weight of metal than in numbers. Gravina with 10 sail, joined by the frigates to leeward, made for Cadiz. The 5 leading ships of the enemy's van tacked and standing to the south, to windward of the British, were engaged and the sternmost taken. The others escaped, leaving to his Majesty's fleet 19 ships of the line, of which 2 were first rates; the Achille, a French 74, after her surrender took fire and blew up; 20 of the enemy's vessels struck, but a gale of wind coming on from the S. W., 15 of the prizes went down, one effected its escape into Cadiz, and 4 only were saved. The 4 ships under Rear-Admiral Dumanoir, which escaped to the southward, towards the close of the action off Trafalgar, after a short respite, shared the fate of their companions, and on the 2nd of November, were taken by Strachan off Ferrol."

To revert to my subject: the commander of the English fleet, seeing the French fleet of 15 sail of the line and 10 frigates, coming at length out of Cherbourg, would for certain, not rest satisfied after blockading them for so long a period, without giving them battle, whatever might be the probable sacrifice of lives with such great odds, or however small the chances of victory; he therefore determines to engage, but acts cautiously; the wind being S. S. E. or S., that is an off-shore wind, well calculated for leaving Cherbourg, or leading down channel. The English form into line, and the French Admiral concludes, that an action is close at hand off Cherbourg; but just before the fleets come within gun-shot, the English Admiral makes a signal to run to leeward; the French follow, and when 10 or 12 leagues off Portland, the English commence a general attack. Some of our ships become crippled from having had to engage with very superior numbers; recourse is now had to a running fight, (thereby covering and aiding the crippled ships), towards the Portland Breakwater, which they succeed in reaching, and where the French dare not follow them, on account of various batteries formed in proper commanding positions, supplied with furnaces for red hot shot, &c. Thus supposing that Portland Roads were converted into a naval station similar to that of Cherbourg, for offensive as well as defensive operations, a British fleet might be preserved as in the instance pointed out, without further risk of exposure to a superior force. A case more strongly illustrative of the utility of the proposed Breakwater cannot be imagined, and unless it be formed, the greater part of a fleet under such circumstances, whilst endeavouring to gain Portsmouth or Plymouth, might be inevitably taken or driven on shore, or lost in the attempt to make a port.

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* It may be necessary, in explanation of this term, to remind the reader that there is near the spot where it is proposed to erect the Breakwater, an *incalculable* quantity of rubble and cap-stone, much more than sufficient to complete a work ten times the extent of the one in contemplation.

As his present Majesty possesses very considerable nautical information, and is more especially well acquainted with the British Channel, the capabilities of Portland Roads cannot have escaped the notice of so intelligent a mind; and if this particular project were submitted to his royal consideration, accompanied with the necessary explanations and references, no doubt its importance would have its due weight, and lead to such an investigation of the subject as might tend ultimately to the appropriation of THIS CENTRAL POSITION, (combining such peculiar local advantages) for effecting a national protecting bulwark for the English Navy, as well as the mercantile commerce of the Kingdom.

Yours, &c. JOSEPH BENNETT.

Supplementary Remarks by Mr. John Harvey.

Previous to the receipt of the above letter from Captain Bennett, I had nearly arranged some valuable gleanings from the Naval History of Great Britain, which will be found strongly corroborative of his interesting observations, and well calculated to fix the attention of the public. I feel persuaded that the design of the Portland Breakwater is such that it only requires to be properly and dispasionately considered to be ultimately adopted.

What said the gallant and experienced Rodney on this subject?

"IF CHERBOURG HARBOUR IS COMPLETED, THEN THE BRITISH CHANNEL IS NO MORE—IT WILL BE THE FRENCH CHANNEL."

The strength and resources of *Cherbourg* are already become (1831) so formidable, and its commanding position in the British Channel so obvious, that argument on the necessity of some effort at counteraction on our part seems scarcely necessary. Sir Walter Raleigh has emphatically observed, that "England is a land which can never be conquered, whilst the kings thereof keep the dominion of the sea." But how, it may be asked, is the dominion of the sea to be kept, without a place of rendezvous for our navy, corresponding in physical efficiency at least, with those of our natural and hereditary political rivals on the opposite side of the Channel? A contemporary writer informs us, that "The extensive works erected at Cherbourg, are calculated to shelter the *entire* French fleet, and numberless works are in progress at the various harbours, lying along the Bay of Cancale." Now, what is there at present on the English side of the channel, which can be at all compared to this? And how can the vast capabilities of Cherbourg, be better matched than by turning those of Portland Bay to an equally good account?

Look again at Portland Bay, considered as a place of shelter for our merchant ships,

> "The ships with shatter'd ribs scarce creeping from the seas."—*Drayton.*

It is in the close vicinity of the very greatest thoroughfare of British commerce. There are constantly not less than seventy sail in sight, between St. Alban's Head and the Start, going up or down channel, and, no doubt as many more that are too far off to be seen.

The chief objection to Portland Roads, in their present state, is the liability of being suddenly caught at anchor there, with a change of wind from west to east. But the following valuable remarks recently communicated by the commander of a cutter, will serve to show, that while there is much force in the objection, it is one which the proposed Brerkwater would most effectually remove.

"On the 23rd, 24th, and 25th of March, 1831, there was a strong gale of wind from E. by N. to E. S. E. when such a heavy sea hove into the roads, that of the vessels riding at the time with two anchors a-head, viz. 2 brigs, 2 smacks, and 2 schooners, one of the schooners was obliged to slip her cable to prevent being driven on shore; and the whole ran the greatest hazard of being drove from their anchorage; they were all pitching very heavy. The vessel alluded to had her decks frequently full of water; and pitched and laboured so much, that she drove with 86 fathoms of chain, and rode the gale out with two anchors down, 93 fathoms on the best bower and 30 fathoms on the small bower. The commander of this cutter observes, that when the winds blow from the S. E. he had always experienced very difficult riding, the bay being so much exposed to the easterly winds, and there being *no shelter whatever to break the heavy sea rolling into these roads.*"

Portland Roads in their present state, may be justly compared to what Plymouth Sound was, before protected by a Breakwater, when southwardly gales prevailed, and

> "——— blustering winds had roused the sea."
> *Milton.*

The benefits that would arise from Portland Roads, when sheltered by the proposed Breakwater,

> " Like a rock unmoved, a rock that braves
> The raging tempest and the rising waves."
> *Denham.*

are not sufficiently appreciated, even by sea-faring men in general. These would consist chiefly in the protection which it would afford against heavy gales of wind, and the swell of the sea—in its offering on all emergencies, a good anchoring ground—and its being at a proper and convenient distance from the shore,

> " Hither the seas at stated times resort,
> And shove the loaden vessels into port;
> Then, with a gentle ebb, retire again,
> And render back their cargo to the main."
> *Addison.*

East and West India shipping, as well as other vessels, homeward bound, are frequently ten or eleven days beating about in the Channel, with easterly winds, whose commanders would gladly make for the Portland Breakwater.

> " O turn thy rudder hitherward a while,
> Here may thy storm-beat vessel safely ride."
> *Spenser.*

Ships of the navy also, when off Portland, under similar circumstances, are obliged in gales of wind, to bear up for Plymouth, instead of making good their distance under the proposed shelter, and proceeding eastward therefrom, the first favourable change.

One yard of the Cherbourg Breakwater (the whole of which was hewn out of Granite rock) contains four times as much stone as one yard of the proposed Portland Breakwater. Such a work, if erected, at any other part of England, would cost at least ten times as much as at Portland Roads; a difference arising from the ready access to the waste cap-stone in the island, which is at present of no value, and would cost little more than the expense of removal.

France, *the second maritime power in Europe*, is commencing a new era in her naval history: and *Cherbourg*, by strengthening the French marine, *if left unchecked*, by some such means as those now proposed, must greatly reduce England in the scale of national importance.

The French have already taken the lead of us in the application of steam power to vessels of war: they have now (including those that are on the stocks) 30 steam ships, some of them 161 feet in length, which is within 10 feet of the length of the Victory. They are to be armed with Paixhan's guns of 12 inch bore, carrying a hollow shot; some of them have 4 wheels, and 4 engines of 60 horse power each. In the French navy estimates for 1829, the Minister of Marine demanded an extra sum of 7,000.000 francs for the express purpose of building steam vessels. Our public men must see in these circumstances, another strong reason for encouraging every plan that can add to the national strength and security of our insular situation.

A naval occurrence is related in Campbell's Lives of the Admirals, vol. v., p. 458-66, which forcibly illustrates the value of such an asylum for the British fleet as Portland Bay would afford, if protected by a breakwater.

" The French fleet, under the command of M. D'Orvilliers, consisting of 28 sail of the line, and several frigates, sailed on the 4th of June, 1779, from Brest, to form a junction with the Spanish fleet at Cadiz; and having effected it, their combined force, consisting of 66 sail of the line, entered the Channel, and paraded triumphantly for two or three days before Plymouth; while several French frigates anchored in Cawsand Bay, and captured some of our coasting-vessels. The Ardent, of 64 guns, commanded by Captain Boteler, standing down Channel, fell in with the enemy's fleet, and mistaking it for the British, was surrounded and captured in sight of Plymouth. Admiral Sir Charles Hardy's fleet, consisting of 37 sail of the line, 8 frigates, 1 20-gun ship, 2 of 14 guns, 2 of 12 guns, 6 fire-ships, and 4 cutters, had sailed from Spithead on the

16th, to cruise in the soundings; yet, from some circumstance which has never yet been accounted for, the enemy escaped the notice of the British fleet, and threw the whole kingdom into a state of consternation. The strong easterly winds which blew for several days, forced the combined fleets out of the Channel, and, at the same time, prevented Sir Charles Hardy from getting into it. The wind shifted to the westward on the 31st of August, and the British fleet gained the entrance of the Channel in sight of the enemy, who were unable to prevent it. Nevertheless, they followed our fleet until sunset, when, being a little to the eastward of Falmouth, they hauled to the south-west, and stood out of the Channel. Sir Charles Hardy proceeded off the Edystone, where he anchored, the fleet waiting the return of the flood-tide; and the next morning, the whole fleet reached Spithead. The enemy's combined fleets were attended by 22 frigates, 9 fire-ships, bomb-vessels, sloops, two armed *en flute*, and an hospital-ship besides several other vessels of war. The general consternation of England was however productive of one good effect—it roused the Ministry out of their dormant state, and compelled them to take measures more correspondent with the public emergencies. A greater degree of activity henceforth was observable in the naval and military departments; and, from this period, all apprehensions relative to the security of Great Britain itself ceased."

Now, though a squadron at Plymouth might not alone be able to cope with so powerful a combined fleet as that which the enemy sent forth on the above occasion, yet if a reinforcement were at hand at Portland, the scale might preponderate, and their junction lead to important results. If such a junction, on the contrary, were depending on the force at Portsmouth, the Nore, and Woolwich, it could not be effected. Again, were an enemy in superior numbers to chase an English fleet to the Isle of Wight, with a strong gale at N. W. or N. N. W. during the night, or in thick weather, they must run for the Downs, as Spithead could not be reached, and the slow-sailing ships of the fleet having so far to run, would be left behind; whereas, an English fleet chased up Channel, could find shelter at Portland, either by night or day, and be thus preserved; supposing that a running fight could not be maintained against great odds.

The following extract from James's Naval History of Great Britain, vol. i. p. 126, 127, shows the advancement of Cherbourg in the scale of national importance at the period of 1793, as well as its central position for privateers. An English look-out fleet off St. Malo's, rendezvousing at Jersey and Guernsey, might easily run to Portland, or receive reinforcements from thence. It has been usual in time of war to order outward-bound ships to join convoy at Spithead and the Motherbank; and large fleets of valuable ships have been thus collected together, waiting a fair wind down Channel. But after leaving Spithead, owing to the wind shifting to the westward, they have been under the necessity of coming to anchor in Portland Roads, instead of keeping to sea with contrary winds, and risking their being captured by privateers. These fleets have been generally convoyed by a frigate or two. Now, in the present state of Portland Roads—quite open seaward—whenever the English blockading squadron happened to be blown off its station by a strong southerly gale to Spithead—which wind would confine it there—nothing would be easier for the French than to put a force to sea from the opposite port of Cherbourg, and capture or destroy the greater part of the fleet in Portland Roads, or force them to cut cables and run on shore.

"1793. Although Brest, L'Orient, Rochefort, and Toulon, until the recent enlargement of Cherbourg, were the only ports in which France usually did, or perhaps conveniently could, construct and equip her ships of the line, yet there were many other ports, such as Havre, Cherbourg, St. Malo, Nantes, Bordeaux, and a few others, from which she sent out, singly and in squadrons, frigates of a very superior class, to make reprisals upon the commerce of her enemies, and prevent, if possible, any similar depredations upon her own. From those ports, also, issued forth innumerable private armed-vessels; some of which, belonging to Bordeaux, equalled frigates in size and force."

Another passage of the same author (vol. i. p. 285) is deserving of quotation, as showing the capability of Havre as a sea-port:—

"In the course of the present year (1794) several French frigates, chiefly in squadrons of 3 or 4, cruised about the British Channel, and were very annoying and destructive to commerce. The success that attended this description of force, led to its speedy augmentation; and, from the single port of Havre, 6 heavy frigates were launched and equipped."

From the same work (vol. iii. p. 126) it appears, that under the same circumstances which in one instance compelled the British squadron to abandon their blockade, (an off-shore gale) the French squadron were enabled to put to sea:—

"Brest, January, 1801.—Here lay the French Admiral, waiting for a northerly gale of wind, to blow the British blockading force off the coast. On the 23rd, a storm arose, favourable alike in direction and violence; and late on that night, the squadron of M. Ganteaume weighed and put to sea. The only safe passage under such circumstances, that of Iroise, was now entirely free from British cruisers; but such was the violence of the gale, that, besides carrying away the topmasts of several of the ships, it separated the Indivisible and Créole from the rest of the squadron."

Again, Mr. James (vol. iv. p. 45) explains the advantage possessed by the French and Spanish combined fleets, in having Cadiz on their lee-bow; thereby elucidating the situation of an English fleet, similarly placed off Cherbourg, with Portland Breakwater on *their* lee-bow:—

"October 20, 1805.—The near approach of the British fleet rendering an action unavoidable, the French Admiral, at 8, 30 A.M. made the signal for his ships to wear together, and form the line in close order upon the larboard tack; thereby to bring Cadiz on his lee-bow, and to facilitate, if necessary, his escape to that port. It was near 10 A.M. before the manœuvre was completed; and then, owing to the lightness of the wind, the partial flaws from off the land, the heavy ground-swell, and the incapacity or inexperience of some of the Captains, the Franco-Spanish line was very irregularly formed; so much so, that instead of being straight, it was curved or crescent-like; and, instead of the ships being in line a-head, some were to leeward, others to windward of their proper stations. For the most part, indeed, the ships were two, and in a few cases three deep; thus accidentally presenting more obstacles to the success of the plan of attack decided upon by the British Admiral, than if each French and Spanish ship had been in the wake of her leader. The ships, generally, were under topsails and top-gallant sails, with the main-topsail shivering, and lay a point, or rather more, off the wind."

Mr. James shows, further, (vol. iv. p. 47,) that Lord Nelson was sensibly alive to the great advantage which Cadiz offered as a home-port for the enemy on the lee-bow, when off Trafalgar; and thus adds the highest sanction to Captain Bennett's remarks in his second letter of the 21st of May, 1831, with regard to an English fleet, &c. between Cherbourg and Portland:—

"October 21, 1805.—The direction in which the combined fleet now lay, with a home-port scarcely 7 leagues off on the lee-bow, and the evident forging a-head of the ships, whereby that distance was every minute diminishing, induced Lord Nelson to steer a trifle more to the northward, and to telegraph his second in command, 'I intend to pass through the van of the enemy's line, *to prevent him getting into Cadiz*.' The reserved order of that line, in the prevailing state of the wind, had produced another danger to be guarded against; it had brought the shoals of San Pedro and Trafalgar under the lee of both fleets. Accordingly, at 11·30 A. M. the Victory made the signal (No. 63, with the preparative) for the British fleet to prepare to anchor at the close of day."

In vol. iv. p. 63, Mr. James details the actual arrival of the remnants of the enemy's combined fleets at Cadiz, after the action off Trafalgar; thus fully verifying Lord Nelson's ideas of the lee situation of Cadiz:—

"October 21, 1805.—15 sail of the line escaped, of which number 4 French ships got away to the southward, and 11, 5 of them French and 6 Spanish, and most of the ships much shattered, with all the frigates and brigs, reached the Bay of Cadiz."

In vol. iv. p. 305, is pointed out the facility with which the French can build ships of the line, when required:—

"September, 1806.—Several of the ships here marked down as building, were ready to be launched, and some were actually afloat. Among the ships of the line which Napoleon at the commencement of the war had ordered to be built, were 2 at Nantes, 1 at Bordeaux, 1 at Marseilles, 1 at Ostend, and 1 *at St. Malo*. These have been excluded from the statement, because it is doubtful whether or not they were proceeded upon. In the course of two or three years, every one of the above 21 building ships was actually in commission; and it is believed that, before the close of the year 1806, several other line-of-battle ships, including two or three three-deckers of the class of the Impérial, were laid down in the different ports of the French empire."

In vol. v. p. 2 and 3, we have demonstrated the capability of the French to raise a navy at any time. Cherbourg had long been a celebrated port for frigates, and was then (1808) fast rising into importance:—

"1808.—A new era was commencing in the navy of France. Such had been Napoleon's exertions since the fatal affair of Trafalgar, that the spring of this year saw him possessed of upwards of 80 sail of the line, including 20 recently-ordered to be laid down at Antwerp, Brest, L'Orient, Toulon, and other ports. In Brest, a squadron of 8 sail of the line and 4 frigates was, in the course of the summer got ready for sea, and only remained in Port because unable to elude the vigilance of the Channel fleet under Admiral Lord Gambler, who, since March, had succeeded to the command of it. Early in the year, as will be presently more fully noticed, a French squadron of 6 sail of the line sailed from the road of Isle d'Aix, and large and powerful frigates were occasionally slipping out of other ports along the French channel and Atlantic frontier. Of the minor ports of France, *Cherbourg* was fast rising into importance: the basin there constructing, and nearly finished, would in a year or two, it was expected, be capable of holding a fleet of line-of-battle ships. *It had long been a celebrated port for frigates*, and several very fine and powerful ones had sailed from, and were constructing within it."

In vol. v. p. 347, 348, the author again enlarges on the increasing capabilities of Cherbourg in the year 1810, by the addition of a naval basin capable of holding from 30 to 40 sail of the line, and 20 more in the roadstead. He pronounces it superior to every other French port for carrying on offensive operations in the Channel, from its central and projecting situation. Look to this, ye men of England, and fulfil the bard's original description! I say, look well to this; protect, and rally round

"This royal throne of kings, this sceptered isle,
This earth of majesty, this seat of Mars,
This other Eden, demi-paradise;
This fortress, built by Nature for herself,
Against infection, and the hand of war;
This happy breed of men, this little world;
This precious stone set in the silver sea,
Which serves it in the office of a wall,
Or as a moat defensible to a house,
Against the envy of less happier lands."
Shakspeare.

The following is the passage in Mr. James's book to which I have last alluded:—

"November, 1810.—Some allusion has already been made to the immense works going on in the Port of Cherbourg, by the orders of the French Emperor. The principal improvement consisted of a basin, capable of holding from 30 to 40 sail of the line, with sufficient water at its entrance to float the largest ship when ready for sea. About 20 line-of-battle ships could also anchor in the roadstead, sheltered from every wind, as soon as the *dike*, then constructing at a vast expense, should be finished. From attacks of another sort the ships were also well defended, the three strong fortifications of Pelée, Fort Napoléon, and Querqueville, completely commanding the road. No port belonging to France was so well calculated as *Cherbourg* for carrying on offensive operations in the Channel; not only from its central and projecting situation, but from the facility with which, with any wind in moderate weather, ships can sail in and out of it. Strong gales from north to north-west would, however, occasion a difficulty in getting out, on account of the heavy swell that such winds usually raise in the principal passage. But it is scarcely possible for one or two ships cruising outside, to prevent vessels sailing in the night from Cherbourg, as strong tides, deep water, and a rocky bottom prevent the ships from anchoring; and they cannot, at all times, keep close enough in, to see a vessel under the land. This accounts for the escape of so many French frigates from Cherbourg, until, on the arrival there, in the summer of 1809, of the two French line-of-battle ships, Courageux and Polonais, the port became regularly blockaded. In the autumn of the present year, the British force cruizing off the Port of Cherbourg, consisted of the 74-gun ship Donegal, Captain Pulteney Malcolm, and Revenge, Captain the Hon. Charles Paget; with occasionally a frigate and a brig sloop, to be ready to meet the new French -0-gun frigate, Iphigenie, launched on the 10th of the preceding May, and a 16-gun brig-corvette, which now lay in company with the two line-of-battle ships watching an opportunity to sail out. In the middle of October, the Alcméne, a second 40-gun frigate from off the stocks in the arsenal, joined the Iphigenie, and was soon in equal readiness for a cruize. In the neighbouring Port of Havre, lay also two new 40-gun frigates, the Amazone, and the Eliza, hoping to elude the vigilance of the two British 38-gun frigates, Diana and Niobe, and at all events, to get to Cherbourg, as the *preferable port*, although watched by a British force, *for an escape to sea.*"

In vol. vi. p. 220, we have an account of the opening, with great pomp, of the new-formed port of Cherbourg:—

"On the 27th of August, 1813, the newly-formed part of Cherbourg was opened, with great pomp, under the eyes of the Empress Marie-Louise; and on the 12th of October, the 80-gun ship Zélandais, the first line of battle-ship constructed at Cherbourg, was launched: another was also getting ready with all possible dispatch."

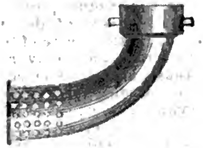
I have thus endeavoured to point out the present inadequacy of Portsmouth and Plymouth as checks to Cherbourg, and to establish, by various corresponding circumstances, the urgent necessity of making Portland Road an effective rendezvous for our navy; that is to say, if it be still with us, as I trust it is, an object of paramount importance to preserve and uphold our maritime supremacy. "Take care," says the great Lord Bacon, "of our *out-work*, the navy royal, which are the walls of the kingdom; every great ship is an impregnable fort—and our many safe and commodious ports are as the redoubts to secure them." And to the like effect Raleigh has observed, "Whosoever commands the sea, commands the trade; whosoever commands the trade of the world, commands the riches of the world, and, consequently, the world itself."

I presume to indulge the pleasing hope, that the observations which I have from time to time addressed to the public on the subject of the Portland Breakwater, will be of some service in bringing about its ultimate accomplishment. If my suggestions should produce such an effect, my purpose will be obtained; indeed, I cannot allow myself to entertain a doubt that, sooner or later, the thing will be done—for the facts stated are strong, decisive, and indisputable. I venture, with all due deference, to assert, that they are worthy of the serious consideration of his Majesty's Government, and I do most earnestly trust they will obtain it. In endeavouring to draw public attention to this subject, I have only done that which every honest Englishman is desirous and bound to do, as far as his abilities may permit him, namely, to employ his best efforts in aid of the service of his country. And with that consciousness which such a feeling naturally produces, I cannot conclude these remarks with a stronger, or more emphatic and truly British appeal, than that contained in the memorable and never-to-be-forgotten signal of the late noble and illustrious Nelson!

"England expects every man to do his duty."

JOHN HARVEY.

PLANS FOR FACILITATING THE SUPPLY OF WATER AT FIRES.



Sir,—I would beg leave to refer your correspondent, Phœnix, (p. 232) to p. 412 of your 8th volume, where he will find a description of an apparatus, similar to that which he has suggested.

The dimensions for the iron reservoir furnished by Phœnix are not those that would be found most useful, it being desirable to obtain *greater depth and less horizontal area.* This being the case, it follows, that a different form of rose, to that proposed by Phœnix, would be required; and I think the following is not very likely to be surpassed. This rose, as the accompanying sketch will show, consists of a cylindrical copper elbow, having a female swivel-screw at the upper end for connecting it to the suction-pipe, the lower end being perforated with small holes to a short distance up. A rose of this kind is used by the London Assurance Corporation, and was designed by their late foreman, S. Buston, for the purpose of enabling their engine to be set to work without taking up more than one or two stones, and it appears to answer the purpose very well. This rose has occasionally been used at fires, where there has been a partial deficiency in the supply of water, and two or three engines have been endeavouring to work from the same dam; in these cases the London has always taken the largest share of the water, from the circumstance of its drawing its supply from a lower point than any of the others, who could only get that portion of water that remained more than sufficient to keep the London in full work. This form of rose is admirably adapted for working from reservoirs, similar to those described at pages 190 and 412, of your 8th volume.

While upon this subject, I would observe, that having made repeated experiments in several parts of the metropolis with the improved stopping-board, described at p. 38, vol. xii. I am now enabled to state, that by the use of that apparatus, in conjunction with the one-and-a-half-inch flat rose, recommended at p. 72, vol. viii. the necessity for taking up any stones at all would be entirely got rid of.

In these experiments I have collected with the improved stopping-board, a body of water, varying from four to seven inches in depth. The rose being 1½ inches deep, would leave 2½ inches of water above it, which is at all times sufficient to ensure a good supply, and to prevent air from being drawn into the engine. I have frequently worked an engine, with a common two-inch cylindrical rose, very conveniently from the body of water collected by this board, without disturbing a single stone!

The time required to set an engine to work by suction with this apparatus, or by a supply of water poured into the cistern from a fire-cock, is about two minutes; and supposing that two competent persons are in attendance with the engine, this time need never be exceeded, except in peculiar cases. This is a celerity which is seldom witnessed in London; in Edinburgh, however, where the fire-engine establishment, under the able superintendence of Mr. James Braidwood, has attained a degree of excellence and efficiency never before witnessed, the time required to get an engine to work, with three lengths of hose (120 feet) attached is *one minute and ten seconds!* Of the admirable system which has been adopted in the northern capital, I shall have occasion to speak hereafter; in the mean time, I remain, Sir, yours, &c.

William Baddeley.

June 17, 1831.

◆

REFLECTING LIGHT-HOUSES.

Sir,—More than fifty years have now elapsed since the light-house at Hunstanton was erected; and it appears from your very useful journal, (No. 396) that light-houses have since been erected in imitation of it: but I am very sorry to say, that the properties of the reflectors at Hunstanton Light-House are still very imperfectly understood. It appears, that those who have made reflectors for this purpose have supposed, that a great reflector would be seen at a greater distance than a small one; but it is not the reflector that is seen at a great distance—it is the light of the lamp seen by reflection. Each of the reflectors at Hunstanton contains 700 small mirrors of looking-glass, every one of which reflects part of the light of the small lamp placed in its focus. To mention some of the imperfections of large reflectors, let it be understood, that if the rays of light from the lamp of an 18-inch reflector impinge upon the reflecting surface at the distance of 10 inches, they will form an angle with the tangent drawn to the curve at that point, of 35° nearly, and more than $\frac{3}{10}$ of the incident light will be lost in consequence of the oblique position of the reflecting surface, and the larger the reflector, the angle of incidence will be still less, and consequently the reflected light must decrease accordingly.

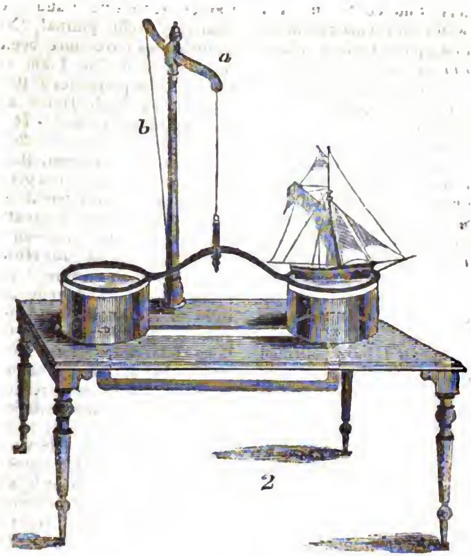
Another imperfection in the construction of reflectors is, the use of silver. Silver, in common use, is a very imperfect reflector of light; but how much it is inferior to looking-glass when used in light-houses, I am not prepared to say, but from the experiments that I have made, silver does not reflect half so much light as looking-glass.

It is mentioned in your journal, No. 396, p. 25, that reflectors have been made of 4 inches focus; such reflectors must be much inferior to those of 3 inches focus, for the intensity of light decreases directly as the squares of the distances. Therefore, $3^2:4^2::9:16$, consequently the light reflected by a reflector of 3 inches focus is as much superior to one of 4 inches focus as 16 is greater than 9. A reflector of 4·3 inches focus would not reflect half the light of one of 3 inches focus, every thing else being the same in both instruments.

Yours, &c.

E. Walker.

Lynn, June 2, 1831.



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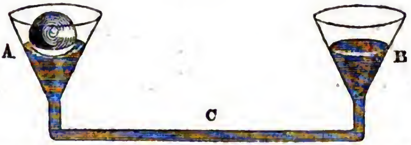
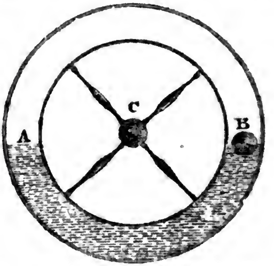


Sir,—While engaged in a train of miscellaneous experiments, I invented the small apparatus which I call a paradoxical hydrostatic-balance. It might, perhaps, prove useful to the public lecturer, as affording ocular demonstration of a well-known, but not very apparent hydrostatic fact; I say not apparent, because of its being of that nature which does not strike a mere superficial observer.

It has long been established, as a law in hydrostatics, that "the whole weight of a body which will float in a fluid is equal to the weight of as much of the fluid as the immersed part of the body displaces." This truth applies as much in the case of the largest as it does to any the smallest floating body. Yet, comprehensive as this corollary may at first appear, it is possible to apply it in a manner which admits of the following very paradoxical proposition, namely, to construct an hydrostatic-balance, in which bodies, however unequal in weight, shall always counterpoise each other, 1 pound or 1 ounce seeming to balance 10, 100, or 1000, as readily as weights exactly divided between the two scales; and the belance, though made ever so delicate, not to lose its equilibrium, when all the weights are transferred to one scale. To show that this is not actually the paradox it seems to be, we shall quote from Dr. Gregory, where, treating on the pressure of fluids, he observes of bodies immersed in them, "the body is pushed vertically upwards, with an effort equal to the weight of the volume of the fluid equal to that of the body immersed. We conclude, therefore, that *if a body is immersed in any fluid whatever, it will lose (relatively) as much of its weight as is equal to the weight of the quantity of fluid it displaces.*" Bearing this principle in mind, it will not appear so difficult to contrive the balance in question—one in which it shall be indifferent whether the weights occupy one or both scales, as in either case the equilibrium will be sustained; and with these preliminary observations before him, the reader will easily understand the following account of this new balance:—

By fig. 1, in the engraving, which may be considered as the principal part of the balance fig. 2, it will be seen that water in the two funnels AB must necessarily always be at the same level in each, in consequence of their junction by the pipe C. This happens, too, if we float a ball or other body in one of the funnels, as, for example, in A. Fig. 2 may be conceived to be two glass basins, answering the purpose of scale bottoms. They are to be connected below by a pipe, the same as in fig. 1, opening into each bason; they are also to be connected by a scale-beam, joined to two brass hoops encircling their rims. A mahogany stand being provided with an oblong opening in the centre, the whole may be set upon it by letting the pipe down the aperture. At the edge of the stand is a brass pillar, with a small lever *a* at top, which on drawing the cord *b* will elevate the scales, so as to expose the connecting-pipe to view. It may be thus raised before experimenting to show that it is in order; water must then be poured into the basins to any height required, after which a small ship, wooden ball, or any floating body, may be placed on the liquid. The effect which must follow on attempting to overbalance the scale, by ballasting the ship, or by other means with bodies floating in one or both the scales, must be self-evident to all who are acquainted with the laws of fluids, or who have paid attention to the passages quoted above. The scales can never preponderate so long as the fluid displaced by one or more bodies can have access to the opposite scale; for as the fluid displaced by a floating body is always equal to its weight, and as the liquid always rises to the same level in these scales, it becomes impossible they should do otherwise than balance.

This hydrostatic-balance, like the compound one of Desaguliers, may be introduced to illustrate the impossibility of perpetual motion by a weight removed to a distance from the centre of a wheel.



Take the hollow-rimmed wheel AB, let it be air-tight and half filled with water. Let C be the axle; at B place a hollow ball loaded to near sinking. Such a wheel, however fine its axle may be, or however well lubricated, will not make a single revolution, though the weight occupies that part at which every deluded perpetual-motionist is desirous it should be placed; concluding that by such an arrangement, the production of another Orfyrean wheel must be inevitable. The action of the fluid in this instance is precisely the same as those described in the former.

Yours, &c. **Henry D—.**

Liverpool, June, 1831.

WORKING SHIPS' PUMPS BY MEANS OF A PENDULUM.

Sir,—In a letter dated "Sutton Wash, Sept. 28, 1829," which appeared in your valuable Magazine, vol. xii. p. 264, a plan of working ships' pumps by means of a pendulum, is given as something quite original, and likely to prove useful in the hands of men possessing "nautical science." To convince your readers that this scheme belongs not to the Mr. G. P. who claims it, I shall proceed to relate a few facts, which, will show besides that it is by no means of the utility supposed.

In 1814, a Mr. Hueville went out as engineer for one of the mines at Pasco, in Peru, in a South Sea Whaler, called the Wildman, Captain Leith. This gentleman had a plan for working the ship's pumps, which was copied by the Nimrod, Captain Day, about 1815, and by two or three other ships which had met the Wildman on her passage to South America. The two ships' pumps (which are a-baft the main mast, and on each side the keelson) had their spears lengthened, and fastened to the extremities of a cross bar, on the top of a spar forming the pendulum, much in figure like the letter T. The pendulum working between two upright timbers, had a box at the lower end filled with shot weighing from 150 lbs. to 2 cwt., and had a space of six or eight feet to swing in athwart ships. As the ship rolled, the pendulum was to work both pumps; this, however, it would only do when the ship was sailing afore the wind; it then worked well enough, but had little or no effect when she was on a wind. The report of one vessel that adopted this mode of pumping on her voyage round Cape Horn, when she was in a very leaky state, is rather favourable. It used to be the practice on board, when the ship made much water, for two hands to work the pumps alternately (that is before they had the pendulum rigged up) until the time for relieving watch: this took place every four hours, and then, before the watch was relieved, all the men, 13 in number, worked the cistern dry. In a case like this, if the ship was *afore* the wind, by using the pendulum, the labour of the two men could be dispensed with; but the joint assistance of the whole of the watch was requisite, as before, previous to their being relieved. When the ship is on a wind, the pendulum becomes useless, and ought to be lashed to the mainmast, as it is impossible to work the weather-pump; so that the lee-pump only can be used, by shipping the brake or handle of the pump in the common way.

Yours, &c. D.

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LONDON MECHANICS' INSTITUTION.

The following is a list of the prizes offered to the members of this Institution, for the present year:—

For the best essay on the following question: "If knowledge be power, and that power be applied to the extension of the mechanical and commercial resources of a kingdom like Great Britain, how does it happen that such a nation does not command the commerce of the whole world, and find its resources sufficient to keep the labouring population out of a state of poverty?—A Prize of 6*l*., by T. H. Holdsworth, Esq., F. G. S., one of the Vice Presidents.

For the next best essay on the same subject, 4*l*., by the same.

For the best essay on the nature and application of steam; a prize of 10*l*., by Dr. Birkbeck.

For the second best essay on the same subject; a subscription prize of 5*l*.

For the best plan of manufacturing a concentric conical steam boiler on the principles stated in Major-General Viney's specification;* a prize of ten guineas from the patentee, to be awarded after the efficacy of the plan has been *fully* proved!

For the best essay on emigration, which it is expected will comprehend an investigation of the following questions:—Is not the present depressed state of the operative and labouring classes in the United Kingdom, attributable to a superabundance in the supply of labour, as compared with the demand for it? and, if this be the case, is not emigration to a new country, where the demand for labour exceeds the supply, an efficacious, humane, and natural remedy for such depressed condition? A prize of 10*l*., from W. Bingham Baring, Esq., M. P.

The competitors for these prizes must have been members of the Institution six months previous to the 1st of November, 1831, by which day all essays on the several questions must be forwarded to the secretary.

We cannot help thinking, that the prize offered by Major-General Viney has quite as much the Major-General's own benefit in view, as that of the members of the Institution. It is not to be awarded until proof is exhibited of the efficacy of the invention, and all the profit of the invention, when achieved, is to go to the Major-General! No one can venture on the construction of such a boiler, without incurring a considerable expense for mere materials;

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* The specification may be seen on application to Mr. Christie, the Secretary.

and besides this, there must necessarily be a good deal of time and labour thrown away in the pursuit. It is scarcely to be supposed, that *many* mechanics will be tempted to run such a risk, for the paltry sum of 10*l.* Let the General say, that he will well pay the man who will show him how to make such a boiler as he wants, and offer the prize into the bargain; and then there is no question he will accomplish his object.

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PROBABILITIES OF LIFE.

Sir,—As I have reason to think that the following calculations of Buffon are not generally known, I send them you in English, that you may publish them, if you think it worth the while. As far as I can judge, these estimations of Buffon's as to the chances of human life. are considerably at variance with those now acted upon by the insurance offices in this country.

A Table of the Probabilities of the Duration of the Life of Man, calculated from the Mortality Bills of three Parishes in the City of Paris, and twelve country Parishes in the neighbourhood of that City, with Remarks.

By M. De Buffon.

The first column of each of the three divisions of this Table, contains the age of the person; and the second column contains the number of years and months, during which a person of that age has an equal chance to live.

Age.	Duration of Life.		Age.	Duration of Life.		Age.	Duration of Life.	
Year	Years.	Months.	Year	Years.	Months	Year	Years.	Months.
0..	8	0	29..	28	6	58..	12	3
1..	33	0	30..	28	0	59..	11	8
2..	38	0	31..	27	6	60..	11	1
3..	40	0	32..	26	11	61..	10	6
4..	41	0	33..	26	3	62..	10	0
5..	41	6	34..	25	7	63..	9	6
6..	42		35..	25	0	64..	9	0
7..	42	3	36..	24	5	65	8	6
8..	41	6	37..	23	10	66..	8	0
9..	40	10	38..	23	3	67..	7	6
10..	40	2	39..	22	8	68..	7	0
11..	39	6	40..	22	1	69..	6	7
12..	38	9	41..	21	6	70..	6	2
13..	38	1	42..	20	11	71..	5	8
14..	37	5	43..	20	4	72..	5	4
15..	36	9	44..	19	9	73..	5	0
16..	36	0	45..	19	3	74..	4	9
17..	35	4	46..	18	9	75..	4	6
18..	34	8	47..	18	2	76..	4	3
19..	34	0	48..	17	8	77..	4	1
20..	33	5	49..	17	2	78..	3	11
21..	32	11	50..	16	7	79..	3	9
22..	32	4	51..	16	0	80..	3	7
23..	31	10	52..	15	6	81..	3	5
24..	31	3	53..	15	0	82..	3	3
25..	30	9	54..	14	6	83..	3	2
26..	30	2	55..	14	0	84..	3	1
27..	29	7	56..	13	5	85..	8	0
28..	29	0	57..	12	10			

By this table, says Buffon, we may see, that it may be reasonably hoped, that is to say, we may lay or bet one to one, that a new-born infant will live eight years; that a child of one year old will live 33 years more; that a child of full two years old will live 38 years more; that a man of twenty complete will live

33 years and five months more, and so of all the other ages. Buffon adds the following observations: "1st. That the age at which the longest life is to be expected, is the age of seven; because we may lay an equal wager or one to one, that a child of that age will live forty-two years and three months longer. 2nd. That at the age of twelve or thirteen, we have lived a fourth part of our life, because we cannot reasonably expect to live above 38 or 39 years longer; that in like manner, at the age of 28 or 20, we have lived one half of our life, because we have but 28 years more to live; and lastly, that before 50 we have lived three fourths of our life, because we can hope but for 16 or 17 years more. But, says he, these physical truths, however mortifying in themselves, may be alleviated by moral considerations; for a man ought to consider the first fifteen years of his life as nothing. All that happened, all that passed in that long interval of time, is effaced out of his memory; or at least has so little relation to the views and affairs which after that time take up his thoughts, that it gives him no concern. It is no longer the same succession of ideas, or, we may say, the same life. We do not begin our moral life till after we have begun to regulate our thoughts, to direct them to a certain future view, and to assume a sort of consistency, a relation to what we ought to be afterwards. By considering the duration of life in this light, which is the true one, we shall find, from the table, that at the age of 25, we have lived but a fourth part of our life; that at 38 we have lived but half of it, and that we have not passed three fourths of it until the 56th year of our age," &c. &c.

To make the necessary remarks upon the above conclusions of Buffon, would require much more time and space than I can at this moment command; so I leave them, as I find them, for the reflection of your readers—and am, Sir,

Your obedient Servant,

F. M.

IMPROVEMENT IN PRINTING PRESSES.

Sir,—Having noticed in your Journal of May 21, the Report of a Committee of the Society of Arts for Scotland, appointed to consider suggestions which had been made to the society for the Improvement of the Printing Press, in which they submit the "outline" of a plan to effect the desired improvement, which consists chiefly in the application of machinery to enable the press to ink itself; and observing, that it is stated that such an application has been effected in America, I thought you might render your readers a service by informing them, that the machine which is in such successful operation in the United States, has been patented in this country; and that arrangements are making speedily to furnish them to the trade.

The plan proposed by the committee, if practicable, must, it appears to me, prove wholly abortive; inasmuch as printers would be under the necessity of laying aside the presses they now have—an expense which few would be willing or able to incur.

The new inking-apparatus, known by the name of "Wood's Inking Machine," may be applied to the common hand press, with but a trifling fixture that may be made by an ordinary blacksmith; and the press made to ink itself without a single additional motion on the part of the pressman.

A press with such a machine attached to it, being worked by a single hand, and, consequently, at about half the former cost, the advantages of such a machine, particularly that of enabling the common printer to compete with the owners of steam presses, and to oppose the monopoly created in his business by the introduction of machinery requiring an expenditure of capital, to which few are adequate, need not be insisted on.

Yours, &c.

A Printer.

"SAMSON CARRYING OFF THE GATES OF GAZA."

We are not in the habit of noticing productions in the fine arts; but we may well be excused for deviating from our usual course, to bestow our meed of praise on so extraordinary a result of genius and application, and that strictly of a mechanical nature, as is exhibited in an engraving which has just appeared under the above title. The carrying off the gates of Gaza by Samson was a great achievement in its way; but not more wonderful, perhaps, as an exhibition of strength, than this pictorial representation of the event is as a work of art.

We are assured that six months ago, the artist, Mr. James G. S. Lucas, had never tried his hand at any sort of engraving whatever; and yet we see in the production before us, a degree of skill in mezzotint engraving displayed, that would do honour even to a Martin. We really think we do not exaggerate the merits of the piece, when we say; that both in composition and in mechanical execution (for Mr. Lucas is the designer as well as engraver) it is fully equal to some of Martin's best productions.

◆

HYDRAULIC MOVER ON THE PRINCIPLE OF BARKER'S MILL, FALLACIOUS.

Sir,—I would inform "A Journeyman Mechanic," that "the statement, in the pamphlet on hydrostatics by the Society for Diffusing Useful Knowledge, as to the effect of Barker's centrifugal mill," *is correct;* and yet no power can possibly be gained, or motion produced, by the scheme suggested at p. 249.

The designer of this scheme has overlooked the fact, that the effect produced by Barker's mill depends upon the height of the column of water by which it is impelled; and that if this height be nothing, the result will also be nothing.

On turning to p. 249, it will be seen that the height of the acting column of water in the upright tube A, is neutralized by its being made one leg of a syphon, which is nearly counterbalanced by the other leg I. The difference between the two legs does not give a sufficient height of acting column to overcome the friction of the water-way and turn the arms; much less to drive cog wheels, work pumps, and overcome the friction of machinery. I doubt not these remarks will set the "Journeyman Mechanic" thinking, and lead him again to peruse attentively the interesting treatise which he has not yet fully understood. I cannot help smiling at the self-complacency with which he gives up the benefits of his invention *pro bono publico;* may his next attempt succeed better.

Yours, &c. WM. BADDELEY.

June 21, 1831.

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MISCELLANEOUS.

Perpetual Motion.—It is related, in Hutton's Dictionary, that Edward Wright, the Mathematician, made for his pupil, Prince Henry (son of James VI.) a large sphere, and that "*there was in it a work for a motion of seventeen thousand one hundred years, if it should not be stopped or the materials fail.*"—"This sphere," it is added, "though thus made at a great expence of money and ingenious industry, was afterwards, in the time of the civil wars, cast aside amongst dust and rubbish, where it was found, in the year 1646, by Sir Jonas Moore, who, at his own expense, restored it to its first state of perfection, and deposited it at his own house in the Tower, among his other mathematical instruments and curiosities." *Query*—is this curiosity still extant?—*Dios.*

Old Tea Leaves and Regent's Punch.—After every thing that hot water can extract from tea leaves has been extracted, they will still yield, when subjected to the searching power of any strong spirit, nearly as strong an infusion as ever. Whoever, therefore, is ambitious of rivalling, at a cheap rate, his late Majesty (of comfort-loving memory) in the flavour of his punch, he has only to save the waste contents of the morning's tea-pot, for the improvement of the evening bowl.—*An Economist.*

Extraordinary instance of Mirage.—It is no uncommon thing for a spectator at Ramsgate to see the tops of the four turrets of Dover Castle over a hill between Ramsgate and Dover; but Dr. Vince relates, that on the 6th of August, 1806, at 7. P. M., he actually saw from this place *the whole of Dover Castle*, as if it had been brought over and placed on the Ramsgate side of the hill. The image of it was so strong, that the hill itself was not seen through the mirage.

Artificial Garnets.—Take two ounces of pure white glass, one ounce of glass of antimony, one grain of the powder of Cassius, and one grain of Manganese—reduce the materials to powder, mix them intimately, and then fuse them in a crucible. The product will be a gem so like the real garnet, that no common observer will discover the difference.

Woods.—M. F. Tourney, the Inspector-General of the *Parc de Boulogne*, in a work which he has recently published on the Management of Woods and Forests, classes woods under three different heads—hard, resinous, and white woods; and he states, as the result of numerous experiments, that most of the hard woods lose, by drying, two-fifths in weight and one-twelfth in bulk, while the resinous and the white woods, lose about a half of their weight and a sixth of their bulk.

◆

INTERIM NOTICES.

"*Non mihi sed mundo.*" The friend with this motto, is informed that it has been owing to a misconception, now cleared up, that a particular communication of his, which will appear in next Number, was not long ago inserted. A continuation of his correspondence is respectfully requested.

A. J. B. will find a letter for him at our office on Monday.

Communications received from an Experimentalist—A. Z.—A Practical Plumber—B. T.—Mr. W. Green—Mr. Baddeley—A. J. E—Samuel Simple. P. T.—Mr. Dakin—F. H.—Mercurius—Mr. Utting.

Errata—vol. xv. p. 237, for "36.524.224 days." read "365·24224 days." P. 238, for "*b* and *c* are points of contrary flexure," read "*b* and *d* are points, &c."—J. U.

In No. 407, p. 202, it is stated in a description of the *Sutton Wash Embankment:* that, "On Thursday, the 5th of May, the noon-tide ceased, and for ever, its flowings over an area including above 15,000 acres?" This is an error; as the quantity of land does not exceed fifteen hundred acres, instead of fifteen thousand.—J. U.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office Court, Fleet Street; where Communications (post paid) are requested to be addressed.
M. SALMON, Printer, Fleet Street.

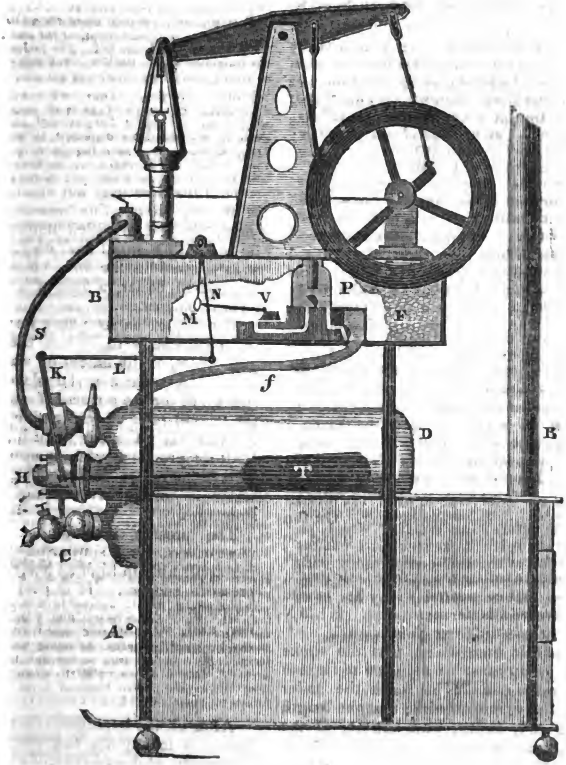
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 413. SATURDAY, JULY 9, 1831. [Price 3d.

"Our delight in any particular study, art, or science, rises and improves in proportion to the application we bestow upon it."—ADDISON.

AMERICAN SELF-ACTING FEEDER.



AMERICAN SELF-ACTING FEEDER.

The engraving on the preceding page represents a model of a contrivance, which has been recently patented in the United States by Mr. Charles Potts, for ensuring to the boilers of steam-engines, particularly such as are employed for locomotive purposes, such a constant and adequate supply, as may prevent any risk of explosion from a deficiency of water.

AB is the furnace; CD, the boiler, which (in this model) consists of a large three-necked bottle, commonly known by the name of Woolfe's; EF, a box, or cistern, to contain water for the supply of the boiler—the waste steam of the engine is also thrown into this cistern; P is the forcing-pump; *ff*, the feeding-pipe, leading into the lower neck of the boiler; S, steam-pipe; H, a cap, fitted on the lower middle-neck of the boiler; V is a valve in the pipe, which conveys the water to the hot-water pump of the engine. It consists of a circular-plate of metal, and is moveable upon an axis, which passes diametrically across the plate; on the end of the axis which comes through the pipe, a small handle is fitted, to communicate motion to the valve, which being turned edgeways in the pipe, presents scarcely any resistance to the passage of the water to the pump; but when turned flat across the pipe, closes the bore. This kind of valve may be fitted without any extraordinary care, sufficiently accurate to answer its purpose. To operate upon this valve, a float, T, attached to the end of a rod, is placed on the surface of the water in the boiler, the other end of which rod is connected with an axis or spindle, on which the float works as a centre. This spindle may be fitted in the cap H, placed on the top of the boiler; but in many cases the lower end of the tube of the safety-valve, or of the steam-pipe, is found more convenient. On the end of this spindle, which is made to protrude a few inches on the outside of the boiler, another rod, termed an index, is fitted and connected with the handle of the valve above mentioned. KLMN. exhibit these different connexions.

It will be understood, that the stroke of the pump must be adjusted to furnish the *greatest quantity* of water the boiler may at any time require; that the length of the rod, index, and handle, of the valve, must be in such proportion to each other, that when the float is at, or near the lowest point, to which it is thought prudent to allow water in the boiler to subside, the valve shall then be entirely open, and a free passage given for the maximum quantity of water in the chamber of the pump. But, when the float is at the highest allowable point, the valve should then be closed, and the supply of water to the pump, and consequently, to the boiler, cut off.

It is obvious, that as long as the operation of the engine is continued, this contrivance must keep the surface of the water in the boiler, *always* between the above prescribed limits, whatever may be the rate of evaporation, or of the running of the engine.

As this feeder depends for its action upon the buoyancy, as well as the gravity of the float, it is considered by the patentee, that a wooden body, bound or sheathed with metal. is as suitable for the purpose as any that can be devised; should the float become heavier by absorbing the fluid on which it rests, the effect would be to keep the water in the boiler at a greater height above the fire.

That the float may have sufficient play in boilers having flues passing through them, the rod on which it acts may be forked with a small float on each prong, so as to straddle the flue. For a vertical cylindrical boiler, a float of an annular form is suggested.

The index, as its name imports, will serve constantly to inform the engineer and others, of the height of water in the boiler. A scale may be placed by the side of it, for the purpose of pointing out the several rates of evaporation, and also to show when the engine or hand pump (if it is provided with one) should be worked to replenish the boiler, when the water is getting low during temporary stoppages.

The present invention differs from most others, for a similar purpose in being applicable to high as well as to low pressure engines. It is said to answer its purpose in a most satisfactory manner, and, without any peculiar nicety of workmanship in its construction.

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ON ELECTRICITY.

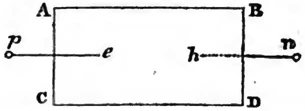
After all the hypotheses that have been invented to explain the pheuomena of electricity, philosophers still entertain various opinions respecting the electrical element. Some philosophers maintain that the spark is produced by two elements (called fluids) passing through each other in contrary directions, forming a double current: but others are of opinion, that it consists of only one divided into two parts, which they call positive and negative electricity; whilst others even hesitate to admit the existence of the electric fluid as completely established.

As many of the phenomena of nature are produced by electrical energy, and as no conclusion drawn from doubtful principles can be admitted in philosophy, it seems indispensably necessary that this disputed point should be determined by clear and satisfactory experiments.

When a card is perforated by an electric spark, it is well known that a bur is raised on each side. This experiment has often been advanced as a proof, that two positive powers pass through the card in contrary directions; but this conclusion is too hypothetical to be admitted as a physical truth, and every other experiment that has yet been made to investigate this point is equally uncertain. As many of the effects of electricity are strictly mechanical, the following experiments demonstrate, on that principle, that the electric spark consists of two forces passing through each other in contrary directions:—

Experiment.

Fig. 1.



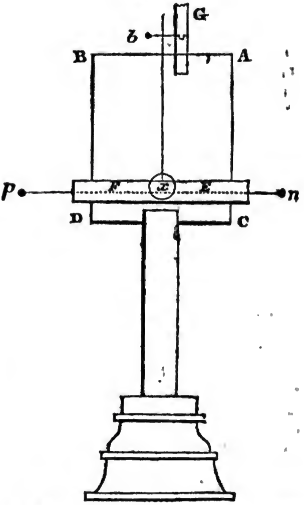
Let a piece of tin-foil, about 3 inches long and half an inch broad, be laid between two cards, 4 or 5 inches in length, and their ends fixed together with paste or gum-water. ABCD represent those cards when laid on a table; *pe*, a piece of wire laid upon the cards, with its end *e* over one end of the tin-foil; and *hn*, another piece of wire laid under the cards, with its end *h* just under the other end of the tin-foil; the distance *eh* between the ends of the wires being 3 inches.

A charge from a Leyden jar being passed through the wires, a perforation was made in the top card at *e*, with a bur round it on the *upper* side of the card, but no appearance of a bur on the under side of the card at *e*. The under card was also perforated at the end *h* of the other wire, with a bur on the *under* side of the card, but none above it.

In this experiment the tin-foil served as a conductor between the two ends of the wires *e* and *h*, which proves that the electric spark is produced by two elements; for, if it consisted of one element only, and passed from *p* to *n*, the burs would have been on the under sides of both cards—and if it passed from *n* to *p*, the burs would have been both on the upper sides of both the cards, which is contrary to the experiment.

By comparing the burs made on the cards, it appears that the two forces, acting in contrary directions, are nearly equal; but as no satisfactory conclusion could be drawn even from these phenomena, an electrometer was contrived, by which these forces are compared to as great a degree of precision as the nature of the subject seems to require.

Fig. 2.



In fig. 2, ABCD represents a card placed in a vertical position upon a stand; E and F, two thin pieces of mahogany glued to the card on opposite sides; *px* and *n x*, two pieces of wire sliding through E and F, till their ends are opposite to each other at the point *x*; G is a piece of wood fixed upon the top of the card, from which two pendulums of equal dimensions are suspended from *b*, on opposite sides of the card, the centres of their bobs covering the ends of the wires at *x*.

The pendulum-rods are made of very thin slips of ivory, and the bobs of card-paper. A hole is cut through the card about an inch square at *x*, and a piece of card-paper is fixed into the square hole between the two ends of the wires, for the electric spark to pass through. As soon as the card has been perforated, it is taken out and another piece put into its place; thus a number of experiments may be made with very little trouble. A thread being fixed to each pendulum-rod, and drawn through separate holes in the card in contrary directions, the bobs of the pendulums may be drawn close to the plane of the instrument.

When an electric charge is passed through the two wires, the pendulums are thrown off in contrary directions, and consequently the threads are drawn through the card, and show the mechanical forces of the two elements.

The length of the threads drawn through the card in eleven experiments by the positive force was 24 inches, and the threads drawn through the card, at the same time, by the other force, improperly called negative electricity, measured 22 inches.

In four of these experiments the mechanical forces were equal, in some of the rest the positive acted with greater energy than the other element, and in others it acted with less; but these differences were only such as might have been expected from the nature of the elements which were the objects of investigation.

Whence we may infer, notwithstanding this small difference, that the electric spark is composed of two elements, passing through each other with equal forces in opposite directions.

We are led by these experiments (which it is proper to state have been before related in Walker's Philosophical Essays) to an important general conclusion. As no effect can be produced without a cause, it is necessary to inquire what causes the lightning to fall to the ground from the clouds almost instantaneously; it cannot be the attraction of the earth, because lightning is imponderable, and therefore this effect must be produced by some other cause. "It is known," says Sir Isaac Newton, "that bodies act upon one another by the attraction of gravity, magnetism, and electricity; and these instances show the tenour and course of nature, and make it not improbable but that there may be more attractive powers than these." Newton's conjectures appear, by the preceding experiments, to be perfectly correct, as electricity consists of two attractive powers of equal forces, and these electric forces cause all the phenomena which are daily taking place in our atmosphere. A cloud being highly charged with one of the electric elements, attracts the other element out of the earth,* and at the moment of their meeting, an explosion takes place, producing all the effects of a thunder-storm.

All high objects, such as trees, high buildings, and so forth, serve as conductors between the earth and the clouds, and hence we may conclude, that all metallic rods attached to buildings are dangerous erections; being better conductors than the buildings themselves, they may consequently attract the electric power from clouds at a greater distance.

(To be continued.)

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SKETCH OF AN IMPROVED SYSTEM OF METEOROLOGICAL OBSERVATIONS.—WITH A DESCRIPTION OF TWO NEW METEOROLOGICAL INSTRUMENTS.

Sir,—I beg leave to send you the following specification of some proposed improvements in meteorology, with figures and description of two new instruments; they have been drawn up expressly for the Mechanics' Magazine.

I am, Sir, Yours, &c.

N. S. N.

Edinburgh, June 2, 1831.

1.—A foreknowledge of the wind and weather is an object so interesting to all classes of men, that a system which should with certainty explain the connection between the variations of the different meteorological instruments, and the changes in the atmosphere under all circumstances, becomes greatly desirable. To seamen especially, whose safety and success depend so much upon being prepared for changes in the wind and approaching storms, it would be an acquisition of the first importance.—Much has been done towards this end, but so much appears to remain yet to be accomplished, that a complete system is rather the object of anxious hope, than of reasonable expectation. The following confessedly imperfect remarks, by pointing out a mode of facilitating our progress may not prove uninteresting, whilst they may, perhaps, elicit information on the same subject from others who have applied their attention to it.

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* Proved by experiments.

2.—To a certain degree we are all capable, without instruments, to fortel the weather was far as we are guided by the present aspect of the sky. The rising or falling of the mercury in the barometer, also *generally* indicates the continuance of good, or the approach of bad weather. All such predictions, however, become only loose conjectures, when attempted for any period in advance: and in the usual way in which they are applied, are quite inadequate to convey any accurate or trustworthy information. The question which we would therefore propose for examination is—whether it is possible, from the several continuous indications of the barometer, thermometer, hydrometer, &c., for one twenty-four hours, to ascertain what will be the continuous indications of the same instrument for the next 24 hours? Or, if not for so long a period without a risk of error, what is the increasing ratio of the liability to inaccuracy? and for what period in advance can such conclusions be depended upon?

3.—Were we placed in a situation capable of viewing, at one glance, the internal state of the whole terrestial atmosphere, of witnessing the various currents, distinguishing the several densities of temperature, and general constitution of its parts; we should then be capable of tracing the relation of the different changes—of observing their modifying influence upon each other. We could mark how a partial an increase of temperature gives rise to currents and winds, and how, in mingling together, they change their direction and temperature, form clouds, and beget an infinite variety of different phenomena. We could likewise then notice how far the state of our portion is influenced by the contemporaneous state of every other; and how the motion of even a single atom is not exactly the same, if any portion, however remote, has not the temperature, density, and motion, which it previously possessed.

Without proceeding further on this supposition, it is evident that the nearer we can approach to this situation, by the employment of every artifice in our power, the more clearly will we be able to perceive the connexion of phenomena taking place, at different points on the earth at the same time, and the more fit and ready will we be to seize every opportunity of making advantageous use of the immense mass of observations already collected, and lying dormant in the different meteorological registers. It may, on first consideration, be thought impossible to find means of placing the wind in a situation to grasp the infinity of different objects and relations, which such a view of the atmosphere would present. But if we glance at a map of the world, or of any particular country, we soon perceive that, in such we are effectually made acquainted with as infinite a variety of particulars, and in a manner the most simple and elegant. The magnitude of continents, the distances of empires, the shape and positions of islands, rivers, lakes, and seas, are at once known; and these, if alone registered, by latitude, longitude, and verbal description, could only be referred to by the most laborious efforts of the mind, and would utterly fail of ever becoming of practical utility. Now, although there is this material distinction between the two cases, that the former has reference to a state of motion, whilst the latter represents a state of rest; yet, as we will shortly perceive, they may be so far assimilated, that important advantages will accrue to the former, by pursuing the method of linear development employed in the latter; and it is from the peculiar application of this method, that we can alone expect to overcome the many difficulties, which so unceasingly beset us in pursuing this investigation.

4.—We come, in the first place, to

inquire how it is possible to construct a map, which will show the state of the atmosphere over any portion of the surface of the earth, at any given time. As far as our purpose requires, this will be ascertained with sufficient accuracy, if we knew respectively the density and temperature of the air, the quantity of moisture it holds in solutions, and the direction and intensity of the wind. In what way, then, are we to represent all this in an intelligible form, on a skeleton map of a country such as Great Britain?

Fig. 1.

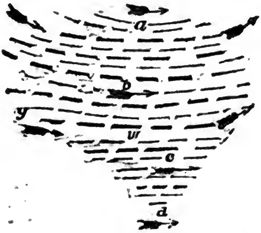
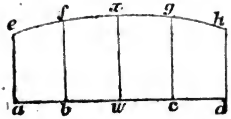


Fig. 2.



The direction of the wind, it is obvious, may be shown at different parts of the island, simply by drawing at three points in the map arrow marks, pointing in the direction of the current, and between these, small broken lines; similar to the manner in which Huygens constructed his map of the magnetic narration. (see Fig. 1) The velocity of the wind, may likewise be shewn at the same time, by marking these lines stronger and closer together, in proportion to its intensity; thus marking those parts darkest where the current is strongest.

5. — When greater accuracy is required, the velocity of the wind may be marked numerically on the different parts of the map, when the observations were taken, and thus sectional lines may be formed either in the line of the current, perpendicular to it, or in any other convenient direction, by transferring the relative distances to a base line, and raising ordinates proportional to the velocity of the wind at those points.

The accompanying figures will show what is meant. *a*, *b*, *c*, *d*, (Fig. 1) are points in the map nearly perpendicular to the direction of the current; at which the wind at the same hour of the same day, has been observed to be of the respective intensities, 7, 8, 9, 6; if we now on the line *a* (Fig. 2) take *ab*=*ab* (Fig. 1) *bc*=*bc*, &c., and raise the ordinates *ac*, *bf*, *cg*, *dh*, respectively equal to 7, 8, 9, 6, the curve line *ef*, *gh*, will show the varying intensity of the wind at every point on the line *ad*; and thus the intensity *wx*, at any intermediate point, *w* will likewise be found, which may be usefully employed in determining a similar curve on any other base line *wy* (Figure 1). In this manner may the varying directions and velocity of atmospherical currents, over an extensive tract of country, be exhibited in the simplest manner, for studying with great ease their mutual dependence and connection.

6.—The actual direction and velocity of the wind, at any time and place, and the ratio of variation or contour of the curves, described by the tracing *p*, *p*, *p*, (vide discription subsequently given of wind gage) is of greater importance, and worthy of being estimated more exactly than is commonly done in meteorological registers, &c. Any alteration or change in the density or constitution of the atmosphere, invariably destroys in a greater or smaller degree, the equilibrium of the surrounding parts; and thus currents are produced, which, if duly examined and properly estimated, might lead, in many cases, to the foreknowledge of the advancing change.

7.—The mode of representing barometrical pressure, temperature, and, indeed all other phenomena, such as quantity of rain, moisture, &c., must, from their very nature, be similar in every respect to that proposed for the velocity of the wind. That the eye may judge with facility, the skeleton map may be shaded darker in proportion to the height of the barometer, thermometer, &c., reckoning in each, from the lowest observations—for it is not the quantity but the difference of quantities, that must catch the eye. If it should be found impossible to perform this with requisite exactness, or if otherwise found inconvenient, the observations may be denoted at the respective situations on the map, by broad black short lines, the length of which must be proportional to the observed heights, reckoning as before, the lowest as zero. As thus:

A general effect of light and shade will thus be produced. If it is wished more minutely to examine the law of variations, in any particular direction, the lunar representation may be constructed by means of ordinates, raised on a base line, already explained in § 5, and for this purpose the nights may also be numerically marked at each place of observation.

8.—It will be necessary in order to avoid the confusion, which would otherwise arise, to construct as many different charts, with different colours, as there are species of phenomena registered; one for the wind, a second for the barometer, a third for the thermometer, &c.; and as the skeleton map will be the same in all, silk paper may be employed, as from being transparent, one may be placed over the other, and thus two or more kinds of phenomena will be exhibited in a combined form, and their mutual influence more readily appreciated.

9.—We have thus endeavoured to point out different methods of protracting contemporaneous meteorological observations, in relation to the extent of country over which the different changes take place. We will now show how the same may be done, when the phenomena take place in continuous succession, at the same place of observation. The continuous flow of time may be represented by a base line which is to be divided into equal parts, for months, weeks, days, or hours, according to the minuteness required; whilst at points in it, corresponding to the times of observation, let perpendicular ordinates be drawn of lengths, proportional to the indications of the instrument, and the curve drawn through the extremities of these lines, will show the extent of the fluctuations in a manner highly interesting.

10.—This method may evidently be pursued with advantage, in registering all the different phenomena except the direction of the wind. They may, however, be assimilated to the general system, by drawing a continuous line intersecting the parallels of direction, as explained in a subsequent description of the wind gauge.

11.—Thus curve lines referred to a rectilineal base, will serve to denote the intensity of effects, which, taken together, exhibit a true indication of the state of the atmosphere, during any period of time, and if placed immediately under one another, so that the vertical parallel may be common to all, the eye will readily be able to trace correlative variations of intensity, which may guide to the discovery of rules admitting of general and extensive application.

12.—The great scope which is given by these means towards effecting this object, may be better conceived, if we consider that at least 4 or 5 different curves, each varying continually in their appearance, all assist in fixing accurately not only the precise state of the atmosphere, but also the ratio of variations of each instrument, or the ratio of increase or diminution at the same time, which is developed by the different inclinations of the curves to the axis. This latter it is impossible to show in a tabular form, and yet there is nothing so essential in guiding us directly to the knowledge of the future.

(To be continued in our next.)

PLAN OF AN ELEVATED RESERVOIR FOR WATER-WORKS.

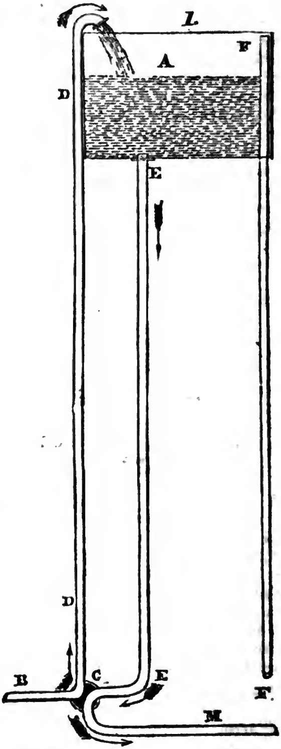
Sir,—I am sorry to find by No. 411, that your esteemed correspondent, Mr. Utting, has in some measure mistaken my meaning, on the fallacy in water-works, which I described in your 408th Number; the more especially, as Mr. Utting appears, by his subsequent observations, to coincide so completely with the opinions I have entertained on that subject.

I am not aware of any part of my communication that will justify Mr. Utting in his supposition, "that I am unacquainted with the nature of the machinery employed in water-works;" on the contrary, I beg leave to repeat, that in several of the water-works in this metropolis, "the ascending and descending columns" *are connected with each other*, and consequently *do form a syphon!* Witness those of the New River, Chelsea, and Lambeth Companies, and others.

Of the *inutility* of such an arrangement I had fully convinced myself, before I ventured the assertion in your pages; and Mr. Utting agrees with me, as to the impropriety of introducing the syphon at all. The *fallacy* of its application to the object sought (the *production* and *maintaining* of a certain pressure) I pointed out at p. 220, nor has any one yet attempted to refute my view of the case. No advantage whatever is gained by the use of the syphon; its disadvantages are, the cost of erection in the first instance—and the unnecessary friction of upwards of 80 feet of pipe, continually.

I felt great pleasure on reading the interesting description of the new water-works at Lynn Regis, furnished by Mr. Utting. The apparent elegance and efficiency of these works, reflects great credit upon Mr. Malam, under whose direction they have been constructed; it appears, however, by the arrangement adopted in these works, that the greatest pressure that can be put upon the mains is that of a column of water the height of the reservoir, stated to be 58 feet.

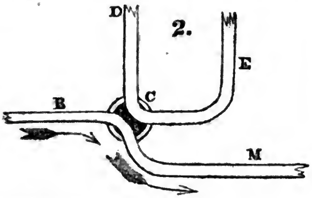
Now, I am of opinion, that occasionally, as in the event of extensive fires, &c., it would be desirable to possess the means of increasing this pressure *ad libitum;* and the following arrangement suggested itself to me some time since, as affording the facility of accomplishing that object.



In the accompanying sketch, fig. 1, A is the cistern or reservoir, at the top of the building. B is a pipe coming from the pumps to the fourway-cock C. D is a pipe proceeding up from the cock C, and emptying itself into the cistern A. E is a pipe from the cistern back to the cock C. M is the pipe leading to the mains. F is a waste-pipe, rising to within 6 or 8 inches of the top of the cistern.

When the mains are to be charged with a pressure equal only to the height of the reservoir, the cock C is in the situation represented; in which case, the water comes from the pumps along the pipe B, passes through the cock C, up the pipe D into the reservoir; from thence it passes down the pipe E, through the cock, into the main M.

But, in the event of a calamitous fire, or any other circumstance, which called for a larger and more rapid supply of water than the former pressure would give; the speed of the engine having been increased, the cock is turned into the direction shown in fig. 2, when the connections with the reservoir are cut off and the water passes direct from the pumps into the mains, being subject to all the pressure the power of the engine can put upon them. The air-vessel would preserve the mains from being injured by any sudden increase of pressure; and a gauge attached to it, would at all times show the amount of pressure with which they were charged, and also warn the attendant when it became necessary to slacken the speed of the engine. A safety-valve would also prevent accidents, in the event of the attendant neglecting to attend to the information communicated by the gauge.



Had an arrangement of this kind, or even that of the Lynn Regis Water-works, been erected on the south side of the Thames, the property that would, in all probability, have been saved from fire in that district during the last 20 years, is almost incredible.

The fact, of water not rising into a cistern 10 feet high, within 2 or 3 furlongs of the works, arises, as Mr. Utting has supposed, in consequence of the engine being considerably below full speed, as compared with the supply required; and the evil arises, in consequence of the engineer supposing that the mains are under a pressure of a 40-feet column of water—which is amply sufficient for the service—while they are, in fact, charged with something less than a 10-feet column; this error emanating from a misconception of the effect of the syphon which they employ.

Yours, &c. Wm. Baddeley.

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IMPROVEMENTS IN CANAL NAVIGATION.

We extract the following interesting historical summary of the progress made in the improvement of canal navigation, from a Report made by the Governor and Committee of Council of the Forth and Clyde Canal to a General Meeting of the Proprietors, held in London on the 4th of May last. The Forth and Clyde is now a very old canal; it has always paid well; and is so advantageously situated, that it has probably less to fear from rivalry than any other. It is particularly pleasing, therefore, to observe that it is not following the usual course of such ancient, well-doing concerns—which is, to let well alone till you let all the world outstrip you—but that its managers are exerting themselves with as much public spirit and assiduity, to keep pace with the general march of improvement, as if they had but just taken the field. *The proprietors of other canals would do well to follow their example.* It seems evident, notwithstanding all that has been said, that canals are still capable of maintaining a very formidable competition with even the best railways that can be constructed.

"When the Forth and Clyde Canal was established in 1768 (and for many years thereafter) Canal conveyance was incomparably superior to every other in point of cheapness. During that period the high roads of this country (even the best of them) from their improper lines of direction, and their general bad condition, were unfit either for the speedy carriage of light articles, or the slower transport of bulky and heavy goods. This prevalent inferiority of other conveyances begot a general opinion that canal conveyance was perfect, and that it neither required, nor was susceptible, of improvement.

"The consequence of this general opinion has been that, during the last fifty years, scarcely any attempts have been made by canal proprietors for improving the established system, except by the widening and deepening of some canals. In the second of these respects (or deepening) considerable improvements, attended with great expense, were effected on the Forth and Clyde Canal; its depth having been increased, first from seven feet of water to eight feet, and afterwards to upwards of nine feet.

"In the meantime, however, great improvements were in progress, and have been carried into effect, on all turnpike roads—insomuch that a cart, drawn by one horse, can now carry double the weight, and at a much greater speed, than what it could have done in the year 1780. The speed with which passengers can be carried, by coaches and chaises, along the turnpike roads has also, during the same period, been doubled. It is plain, therefore, that, unless these improvements on the roads be balanced by corresponding improvements in the speed and facility of canal conveyance, the trade on canals will necessarily be diminished, or at least be prevented from being, as hitherto, progressively on the increase.

"The chief danger, however, to which canals are now exposed, has arisen from recent improvements on railways, but principally from exaggerated accounts that have been published, and delusive opinions now prevalent on that subject, which threaten to occasion the construction of railways, in situations where there are hardly sufficient materials for supplying a limited and moderate trade to the already-established conveyances, and still less for affording a remunerating trade both to these conveyances and a rail road.

"It is true, that the trade on the Forth and Clyde Canal is materially different from that on most other canals, as it arises chiefly from the direct passage of sea vessels through the canal, or between the City of Glasgow, situated near the centre of the canal, and a number of different British and Foreign sea ports. By this means the Forth and Clyde Canal is not exposed to the like competition to which other canals are liable, whose trade consists in the carriage of articles from one particular point to another, or from one part of the canal to another. Still, however, your committee see the necessity of a general improvement of the canal navigation, in order to preserve and increase its present trade; and they have, therefore, for some time past been sedulously engaged in two several measures, by which they trust that the trade and revenue of the canal will be founded on a sure and certain basis, with every prospect of increasing with the progressive improvement of the commerce and prosperity of the country.

"The first of these measures, is *lining, or facing, the upper part of the canal banks with stone, and at the same time raising the height of the banks, so as to admit of an additional depth of water on the surface;* and the second, is *the general introduction on the Canal of Steam Navigation.*

"The necessity of the first measure appears from this circumstance, that at present, many of the large sea vessels navigating the canal are, when fully loaded, of so deep a draught of water, that it is necessary to lighten them during their passage through the canal, which occasions considerable interruption, delay, and expense in the transhipment of part of their cargoes into lighters, and the freight of these lighters. In pursuance of the first measure, therefore, the committee have lined with stone nearly one half of the upper reach or level of the canal (where vessels are most frequently obliged to have recourse to the assistance of lighters), and at the same time that this stone lining was made, the banks have been raised in height. The entire length of the upper reach of the canal will in the course of the present year be faced with stone, and be made ready for receiving an additional depth of water, which, besides enabling the larger vessels to navigate the canal with full cargoes, free of the expense of transhipment and lighterage, will lessen the expense, and facilitate the trackage, of every vessel plying on the canal; it being ascertained, by experience, that an increase of depth of water greatly facilitates and expedites the trackage of vessels on canals. This improvement will also be soon extended to all parts of the canal. The stone facing, coming in place of turf and clay, will effect also a great saving in the constant expense of replacing this turf and clay, which was very quickly washed down by the surge, and which, filling up the bottom of the canal, formed shoals or banks, which interrupted the trade, and put the canal company to the expense of clearing the bottom of the canal by dredging boats, and removing the shoals formed by the clay thus deposited. The prevention of these interruptions, and the facilitating of the trackage, will be an equal benefit to the canal company, their traders, and the public.

"With regard to the second measure proposed, viz. the introduction of steam navigation, it falls to be considered under three distinct heads. First, the cheapening and expediting of canal carriage, by the use of steam boats, for dragging other boats along the canal and neighbouring firths or arms of the sea.—Secondly, the use of steam vessels fitted for carrying goods, not only along the canal, but also between Port Dundas (the harbour of the canal at Glasgow) and the different sea ports on the East and West Coasts of Britain, and the neighbouring ports of Ireland and elsewhere:—and Thirdly, the use of steam boats for the speedy conveyance of passengers and parcels; and thus obtaining to the canal a portion of the large sums now expended on the coaches at present established on the turnpike roads running parallel with the canal.

"So long ago as the year 1802, a trial was made, by direction of the late Lord Dundas, of a steam boat for dragging other vessels along the canal. This was the first public trial of steam for a useful purpose in navigation. In consequence of the imperfect success of this trial, but chiefly in consequence of the pre-conceived opinion, of all the directors and officers of canals, that the action of steam paddles would be destructive to canal banks, the further prosecution of this measure was dropped, and steam navigation, in place of being first introduced into actual practice in Great Britain, was established first in America.

"In the year 1812, in consequence of the success of the measure in America, a trial of steam navigation was made with success on the river Clyde, which led to the complete establishment of steam navigation on that river, and afterwards on most of the rivers and coasts of Britain and Ireland. The prejudice against the use of steam vessels on canals, however, remained still in force until the year 1828, when Mr. Murray, inspector of works on the Forth and Clyde Canal, observing that the Cupid, one of the smaller steam boats employed on the Clyde, was of such a size as to admit of her passing through the canal locks and bridges, proposed to the governor and committee of council, that they should hire the Cupid, and make a trial of her performance on the canal. This proposal being adopted and acted upon, the Cupid was brought into the canal, and full trials were made with her in presence of one of the first engineers now living, Mr. Watt, of Birmingham (a canal proprietor). An account of these trials, and a report of Mr. Watt's opinion, appear in the sederunt book of the committee, on the 6th day of November, 1828. This trial of the Cupid was made and directed solely with the view of proving the capability of steam boats as draggers of other vessels on the canal; as, from the necessary contraction of the beam or breadth of a steam boat on the canal (in order to have room for the side paddles in passing the canal locks, which are only twenty feet wide) the bearing or tonnage of such boats was necessarily very limited, and they would carry only a very small cargo.

"From the result of these trials, Mr. Watt reported to the committee, that it appeared the expense of drawing vessels along the canal, by a steam boat employed as a dragger, would not amount to more than one half of the expense of horse-power, provided the steam dragger could have constant and regular employment. From the uncertainty of obtaining this constant employment, owing to the irregularity of the arrivals and entries of sea vessels into the canal from the various sea ports, the committee have not yet thought it advisable to attempt the establishment of steam draggers on the canal, although they have never lost sight of this measure and still keep it in view. The experiments in question, however, clearly proved the safety and practicability of the use of steam boats in the canal, and exposed the fallacy of the opinion that any greater wave or surge against the banks was occasioned by the paddles of a steam boat, or by a steam boat passing along the canal, than by other vessels of the same dimensions or burden, and moving with the same speed. The wave was found to rise or fall just in proportion to the velocity of the motion of the boat through the water; and the Cupid, when moving at the rate of four or five miles an hour, raised no surge that could be dangerous or hurtful to the banks more than that of other boats.

"Although the committee, therefore, deferred, for the present, the establishment of steam-draggers, their attention was naturally turned to the second object above-mentioned, as attainable by the use of steam; viz. the use of steam vessels of a sufficient burden for carrying goods in their holds, along the canal, and between Port Dundas and the different sea ports on the Firths of Forth and Clyde, and the coasts of Britain and Ireland. The difficulty, however, of framing a steam boat, which, with the paddles, would be fitted to pass easily through the canal bridges and locks, and, at the same time, have such dimensions and bearings as to be sufficient for carrying a proper cargo, and the danger of the paddles, if placed on the side, being destroyed by collision with the sides of the canal, or its locks and bridges, presented most serious obstacles to the success of this measure. But Mr. Thomas Grahame (one of the committee) having learned that on some of the North-American rivers steam paddles, instead of being placed on the sides of the boats, and thus increasing their breadth, were placed at the stern (the outsides of these paddles not extending beyond the outside lines of the sides of the vessel), and Mr. Grahame having obtained from America a drawing and section of a stern paddle steam-boat, the committee determined to construct and try a steam boat of this description on the canal.

"For this purpose they contracted with Mr. Neilson, Engineer at the canal old basin, to alter and enlarge the company's iron passage-boat, Cyclops, which had been built in the year 1825, and to fit her up with a common steam-engine, of fifteen horse-power, for working stern paddles; and Mr. Neilson having fulfilled his contract, the committee employed the Cyclops, as a regular trader between Port Dundas and the town and harbour of Alloa on the Firth of Forth. Notwithstanding the great weight of the Cyclops, from the thickness of the iron plates with which she had been originally built, and the great weight of her steam-engine, which is a low pressure condensing engine, and although she is much under the width of the ordinary canal vessels, she is fitted to carry a cargo of forty tons, and makes the voyage between Alloa and Port Dundas (a distance of upwards of ten miles of sea, and of twenty-nine miles along the canal, in which she passes through twenty locks, being in all a voyage of forty miles and twenty locks) in a space shorter than vessels of a like burden can be tracked by horses the shorter distance from Grangemouth to Port Dundas; and this in all weathers, and with the same regularity as land carriage. She has thus secured to the canal, the carriage of the whole goods passing between Alloa and Glasgow; of which, scarcely any were previously carried along the canal, owing to the uncertainty of making the sea part of the voyage regularly in common sailing vessels.

"This instance of what has been effected, on the canal and Firth of Forth, by the Cyclops, has completely and satisfactorily proved the fitness of steam as a moving and carrying power on the canal, and firths adjacent to it; and it only remains to be proved that this kind of navigation can be extended to the sea coasts outside of the firths, in order to introduce a regular establishment of steam-boats between Port Dundas and all the eastern ports of Britain, and also all the ports on the western coasts of Britain, and the opposite coasts of Ireland. The original objection of the canal being unfit for steam-boats has already, by the use of the Cyclops, been completely removed. The objection that canal steam-boats would not be fit to navigate the adjacent firths has also, by the same measure, been proved to be groundless. But it may be, and is, objected that canal steam-boats are not of sufficient breadth or beam to encounter the waves of the open sea, and that the stern-paddles are not adapted for the wide sea navigation. These objections will soon be brought to the test of experiment, when an improved stern-paddle steam-boat, fitted to carry goods, will be tried on the canal and seas adjacent. The Committee, however, are well assured that the objection founded on the want of breadth of beam has already been set at rest by the experience of the steam-boats plying from the Clyde through the Crinan Canal to Tobermorry, Skye, and Inverness; the beam of these boats not exceeding 15 feet.

"The Committee have now to enter on the third manner of employing steam power on the canal, viz. its application to the conveyance along the canal of passengers and light parcels, at a rapid rate.

"It is here necessary to state that previous to the year 1830 it was held to be an established fact, that the moving of vessels on canals, with a speed exceeding 5 miles an hour, was unattainable, except at a ruinous expense, by the force of horses; and that, if any higher speed could in any way be attained, it would be utterly destructive of the banks, by the wave and surge thereby occasioned.

"Both these alleged facts have been completely overturned by experiments first made on the Paisley or Androssan Canal, at the suggestion and under the direction of William Houston, Esq. of Johnston, and subsequently verified and confirmed by similar experiments in the Forth and Clyde Canal. The improvement, so far as hitherto carried into effect, consists in the use of light gig-shaped boats of considerable length, drawn at present by horses; whereby not only a high speed is easily and cheaply attained and maintained on canals, but all surge or wave is prevented. Various improvements have been made on the shape of these boats in the very short period since they were introduced, whereby the labour of the horses is diminished; and, by the use of light iron in their build, they are not only rendered much stronger, but their weight is greatly lessened.

"It is needless to enter into any detailed account of the nature and progress of these improvements: it will be sufficient to state the practical result on the Paisley Canal, where the improvements have, for many months past, been carried into actual effect. The result is, that with three sets of two horses each, or in all with six horses, a gig-shaped passage-boat, carrying upwards of 70 passengers, is conveyed between the towns of Johnston and Glasgow, a distance of 12 miles, 4 times every day; and that at a rate of speed upwards of 8 miles an hour, including stoppages to take in and let out passengers, at Paisley and elsewhere, and to change horses; or, in other words, by Mr. Houston's improved boat 6 horses now convey on the Paisley Canal a boat, with 70 passengers and upwards, an entire distance of 48 miles per day, at a rate, stoppages included, of upwards of 8 miles an hour. The work is besides quite easy, and the horses, after many months' work, are in an improving condition.

" These improvements have been most carefully observed by the Committee of the Forth and Clyde Canal, and would long ere this time have been effectually introduced on the Forth and Clyde Canal, had not the Committee, at the very commencement, seen the superior advantages of obtaining this quicker speed on the Forth and Clyde Canal by the means of steam power. The Paisley Canal is one of the smallest in Britain, while the Forth and Clyde Canal is one of the largest, and of course much better adapted for the introduction of steam power. The bridges on the Paisley Canal are almost all of stone, under which the dragging-horses pass without throwing off their tracking-lines, or any stoppage, while the bridges on the Forth and Clyde Canal are all draw bridges, where the tracking-lines must be thrown off and again attached, which occasions frequent interruptions and considerable delay and fatigue to the horses in bringing up the boat, after a stoppage, to its former speed.

" It was besides quite evident, that it would be more advantageous for the Canal Company to obtain a speed of 7 miles an hour by steam power, than a speed of 9 miles an hour by horses, as the steam power would not cost one-half of the expense of the present horse power: so that, without going into any calculation as to the effect of an increase of speed in increasing the canal revenue, or without increasing the charge or fare to the passengers in the boats already established on the canal and drawn by horses, a large disposable sum, applicable to the increase of the dividend, might be obtained to the Canal Company from the best source, viz. a diminution of the expenditure. With the improved form of light passage-boats drawn by horses, although a great increase of speed is obtained, yet there is no diminution of expense, nor can it be expected that any very great diminution will ever be obtained; for, though the dragging-labour of the horses is diminished by the use of the improved form of boats, this diminution is counterbalanced by the increased exertion necessary to move their own bodies at a high speed; and it is, moreover, hardly practicable to increase the speed beyond 10 miles an hour. The attention of the Committee has, therefore, been directed to the application of steam, as a moving power, to the improved gig or canal passage-boat. In the mean time, however, a light improved passage-boat has been started from Port Dundas to Lock No. 16, which is dragged by horses, and does the journey in little more than 3 hours, that is, in about one-half of the time consumed by the present large passage-boats of the old construction, so that the public already enjoy the improvement in speed of the gig-shaped boat.

" In the view of introducing steam, as a moving power, in this third species of its proposed employment, the Committee instituted a variety of expensive experiments last year, the results of which appear in the books and minutes of the Company. These experiments were made under the inspection of Mr. Fairbairn, of Manchester, and the Committee subsequently entrusted Mr. Fairbairn and his partner, Mr. Lilly, with the construction of a twin steam-boat, which has been named the Lord Dundas, in compliment to the present Lord Dundas, the principal proprietor of the canal.

" After many delays, the Lord Dundas has now arrived in the Forth and Clyde Canal, and a preliminary trial of her speed has been made in the canal, and it is found that she can, with her present engine and outfit, drag one of the quick passage-boats at the rate of 6 miles per hour, to which purpose she will be applied.

" Since the construction of the Lord Dundas, a new improved steam passage-boat has, by orders of the Committee, been commenced by Messrs. Fairbairn and Lilly. This boat has two stern-paddles, so placed as to be defended from contact with the sides of the canal, while the wheels and machinery do not cut up the accommodation of the boat as in a centre-paddle vessel. This boat is to be in the canal in May, and it is expected that the Lord Dundas and this new boat will do the whole duty of the three passage-boats, at present used by the Company, at a very great reduction of expense, and with an increased convenience to the public, by a diminution of the time consumed in passing along the canal, without any higher rate of fare.

" The Committee are resolved not to

rest satisfied with any partial improvement in the navigation.—*The improvements made in the last twelve months have satisfactorily proved the entire erroneousness of the opinions previously entertained on the subject of the limited powers of canal navigation.* To what length these improvements can be carried it is impossible to say; but it would be equally irrational, and contrary to all experience, to presume that more than a mere step has been made in the short period elapsed since the improvements have been attempted.

"The Committee particularly look to great improvements in the application of steam power at quick velocities on canals, by means of great lessening in the bearings and weight of the engines. From the nature of the medium on which these engines work, and the entire absence of shakes and jerks, not only the engines, but their framings, may and ought to be made of the lightest description. The improvements already made on the locomotive-engines on the Liverpool and Manchester Railway, in lightening the boilers and machinery, may be all extended to canal steam passage-boats, with the great additional advantage that the framing may be also much lightened, as they are not subjected to the shocks which must be encountered on the ruder route of the railway or in sea-boats.

"The Committee also look to the early adoption of steam as a dragger for sailing-vessels on the canal, and expect thereby greatly to increase the general speed of conveyance on the canal, and to reduce the expense or charge to the trader for dragging fully one-half.

"In the various improvements before stated, to which the attention of your Committee has been directed, the Proprietors will observe that the accommodation of the traders and the public has been equally considered with the interests of the Canal Proprietors. By the stone-facing and deepening of the canal all the present charge for lighterage will be saved to the traders in the large class of vessels navigating the canal, while the smaller classes will be easier tracked, and enabled at a less expense to convey their cargoes, and at the same time the annual outlays of the canal for repairs will be diminished. By the introduction of a class of steam-vessels for carrying goods, on an improved model of the Cyclops, in addition to the port of Alloa (which is already connected with Port Dundas) the other ports on the Firths of Forth and Clyde will be brought nearer to Port Dundas, both in respect to the time and regularity with which the voyage is performed; and, by the extension of the navigation to the sea-coasts, Dundee and some other eastern ports will be brought within a day's sail of Port Dundas, and the other ports on the east and west coasts will be connected with Port Dundas, by conveyances as regular and much speedier than land-carriage. In like manner, and without any increase of charge to the parties travelling, the time consumed on the journey along the canal will be greatly diminished, and a saving in outlay effected to the Company. It is quite impossible even to estimate how far the last improvement may be carried. The speed of the passage-boats has already been increased, with a diminution of expense or cost, and this is only the first attempt at improvement. The Committee trust that they will be aided in their attempts by other Canal Companies. The field is ample, and is as yet almost unentered."

THE ANCIENT COINS FOUND AT TUTBURY.

Sir,—Several Papers gave, a short time since, an account of "Money finding Extraordinary" at Tutbury, near Burton-on-Trent. The account states, "that more than 20,000 pieces were found;" and goes on to say, "the coins, which are evidently of the reign of Edward the First, appear to have originally been of the value of 4*d*. There are at least five distinct coinages of the same reign. The most common (and of this there are at least 100 to 1 of the other kind) has a front face of the above monarch; the reverse having a cross, some with *London*, others with *Canterbury*, very legibly struck in the die. Another kind has also a full face of a monarch, in a kind of triangle, *Edw. R.* being very legible; the reverse having a cross, some with *Dublin*, others with *Waterford*, struck in the die. The third kind has a profile of the monarch. The coins are in a very good state of preservation," &c.

Upon the above I would observe, that if the account is *correct*, the discovery is indeed extraordinary, beyond the simple finding of a large quantity of coins of an ancient date. Hitherto there have been no groats of Edward the First discovered; at least, none which have been appropriated to him with any certainty. Again, the pennies struck at Canterbury read CA. CAN. CANT. or CANTOR.

some CANTI. And, lastly, I believe there has never been published a coin of Edward the First with a profile face.

If this should meet the eye of any having a knowledge of coins, or of those who have any of these *side-faced* coins in their possession, perhaps they will favour the public, through your valuable Magazine, with a drawing and description of them.

Yours, &c. Δ.

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NEW MODE OF CONVEYANCE.

Sir,—I beg leave, through the medium of your valuable columns, to suggest a mode of conveyance for letters and small parcels, which I am not aware has occurred to any one, and which I conceive is practicable, and might, in certain cases, be attended with great advantage.

If a pipe were laid under ground, between any two places, as A and B, commencing on a natural or artificial eminence at A; so that, on the whole, there should be a fall of several feet per mile, and water were allowed to flow from a reservoir at A, through the pipe to B, a hollow ball might be conveyed by the current thus produced from A to B. The ball, to contain the letters, &c., and its specific gravity to differ little from that of the water, that there might be as little friction as possible, either against the upper or under part of the tube.

The distance admissible for an uninterrupted tube, would of course be limited; and would depend much on the fall that could be obtained—a fall of 200 feet on 20 miles, or 10 feet per mile, more than which might generally be obtained, would so far overcome the friction both of the fluid and the solid, as to produce a considerable rapidity. Instead of a fall, or in addition to it, a steam engine, might, either by pressure at A, or suction at B, produce the desired current.

At the termination of the tube, the steam might issue over an inclined frame of lattice-work, through which the water would run, while the ball would pass over it, and might roll against a tiller communicating with a bell, to apprise an attendant of its arrival. The attendant would immediately transfer it to the next tube, and so on till it reached its destination.

On consideration, it does not appear to me, that this scheme is *altogether* visionary; but if so, I think it would be instructive to point out the objections to it.

The anticipated advantages are the following:—the expense, after the first establishment, would be trifling—a ball might be sent off every hour in the day without additional expense, and were such a plan adopted for the post-office, letters, if even as long on the *road*, might arrive at their *destination* sooner—the rapidity the balls would travel, say 10 or 12 miles an hour, and I should think more.

Yours, &c. MERCURIUS.

P.S.—Of course there would be two tubes on each road, one with a stream from A to B, the other from B to A.

M.

◆

COMPARATIVE PROFITS OF DISCOUNTING AND INVESTING MONEY AT COMPOUND INTEREST.

(Answer to Question 1, p. 62, vol. xv.)

QUESTION.—*A banker discounts bills at equal intervals, so as to have four returns of his money in the year. B improves an equal sum at compound interest, payable quarterly. Suppose both to have the same interest for their money, how much richer will the banker be than B, at the end of* 20 *years. And give an example in numbers, when the first principal of each is* £10,000, $n = 20$, *and the rate per cent. per annum* 5.

Answer by S. E. Erickson, Pupil, Mansion House, Hammersmith, the Proposer.

First. Assume £10,000 $= a$, $n =$ number of years, $r =$ the interest of £1 per one year, $h =$, number of returns the banker had of his money in the year, $x =$ to the sum be received at the first return. Then, by the banking system of discounting, $x - \frac{rx}{h} = a$, from which $x = a\left(\frac{h}{h-r}\right)$ assume $a\left(\frac{h}{h-r}\right) = h$ and y, the sum he received on the second return of his money; therefore, $y = b\left(\frac{h}{h-r}\right) = a\left(\frac{h}{h-r}\right)^2$. In the same way $a\left(\frac{h}{h-r}\right)^h$ = amount at the end of the first year, and $a\left(\frac{h}{h-r}\right)^{hn}$ = amount for *n* years; or log. $(h$ — log. $(h-r)$ hn + log. a = log. of the amount for *n* years.

Calculation.

$$\begin{array}{lr}
\text{Log. } h\ (4) \ldots\ldots\ldots & 0{\cdot}6020600 \\
\text{Log. } (h-r)\ (3{\cdot}95) & 0{\cdot}5965971 \\
\hline
 & 0{\cdot}0054629 \\
hn & 80 \\
\hline
\text{Log. } a\ (10000) & 0{\cdot}4370320 \\
27354{\cdot}7\ \text{log.} & 4 \\
\hline
 & 4{\cdot}4370320
\end{array}$$

or £27354 14*s.* the amount the banker had at the end of 20 years.

Second. Let R = amount of £1 for $\frac{1}{h}$ part of a year. Then, by the principles of compound interest, $a\,R^{hn}$ = amount, or log. R × hn + log. a = log. of the amount, where $h = 4$ $n = 20$ $a = 10000$ and R = 1·0125.

Calculation.

$$\begin{array}{lr}
\text{Log. R } (1{\cdot}0125) & 0{\cdot}0053950 \\
hn & 80 \\
\hline
 & 0\ 4316000 \\
\text{Log. } a\ (10000) & 4 \\
\hline
27014{\cdot}69,\ \text{log.} & 4{\cdot}4316000
\end{array}$$

or £27014. 13*s.* 9½*d.* amount of B. principal ∴ the banker is richer than B. by (27354..14..0—27014..13..9½) £340. 2½*d.*

[Also answered, but not correctly, by L. E. T. and a Reader at Newark.—EDIT.]

Solution of the Second Mathematical Question, p. 62, vol. xv.

QUESTION.—*Suppose cos. A. sin. B + sin. B = sin. A. cos. B; to determine the relation between the arcs A and B.*

Answer by G. S.

Since cos. A. sin. B + sin. B = sin. A. cos. B. By transposition, sin. A. cos. B — cos. A. sin. B = sin B. But by a well-known theorem, sin. A. cos. B — cos. A. sin. B = sin. (A — B) ∴ sin. (A — B) = sin. B ∴ A is double B.

By B. of Falmouth.

Given cos. A. sin. B + sin. B = sin. A. cos. B. sin. B = sin. A. cos. B — cos. A. sin. B. But sin. A. cos. B — cos. A — sin. B = sin. $\overline{\text{A — B}}$ is a well-known formula in trigonometry; ∴ sin. B = sin. $\overline{\text{A — B}}$, A = 2 B.

[We have been also favoured with a good solution of this question from Kinclaven; but it is longer than both of the preceding answers, and not so simple. That of A. B. C. Jun. is no solution at all.—EDIT.]

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LORD COCHRANE AND MR. ALEXANDER GALLOWAY V. MESSRS. BRAITHWAITE AND ERICSSON.

The opinion of Lord Chancellor Lyndhurst in this case, has been fully confirmed, by the result of a trial at common law, on Tuesday last. The Lord Chief Justice Abbott charged the jury to the effect, that the inventions of the two parties were entirely dissimilar, and the jury found accordingly.

◆

Future State of Intellectualists, &c.—Sir, Your correspondent, Mr. Mackinnon, in No. 410, p. 256, has ventured an assertion as to my opinion on a future state, for which he has no authority. I have referred to the Number (366) to which he alludes, and can find nothing to bear him out in such a conclusion. Indeed, I do not recollect ever to have ventured an opinion on the subject. It is, however, supposed by many learned and pious persons, "that in a future state we shall obtain progressively a degree of knowledge, far superior to that acquired in our present state." But in respect to sensualists, I do not recollect ever to have seen or heard an opinion similar to that stated by Mr. Mackinnon. For, according to this doctrine, I do not see the utility of their entering into a future state at all; it being, moreover, contrary to the information given us in the Sacred Scriptures. The Mechanics' Magazine is not a proper vehicle for theological controversy; but I feel myself justified in refuting the opinion formed by your correspondent in the present case.—Yours, &c. J. UTTING, *Lynn Regis*, *June* 21, 1831.

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INTERIM NOTICES.

Mr. J. E.'s communication is intended for insertion.

Communications received from Mr. J. Smith—An old Sailor—Mr. Baddeley—Messrs. Redfern—Saxula—A Professor of Useful Knowledge—J. R. (Edin.)—Ed. Vocis Rationis—Trebor Valentine—Mr. Nutt—Nemo, Jun.—A Painter—Mr. Utting—R. C. Jun.

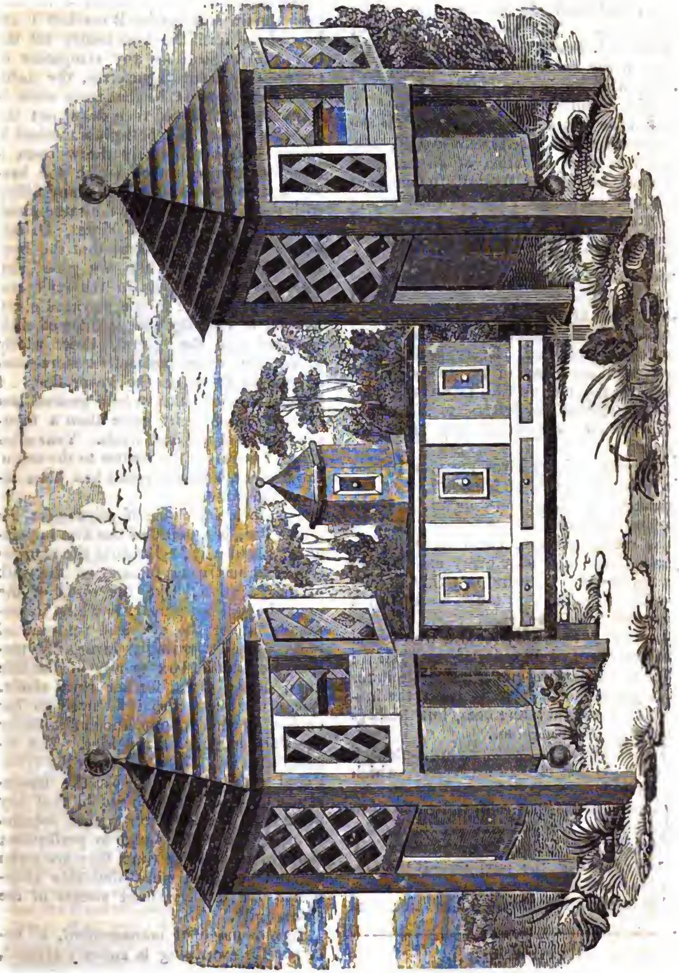
LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office-court, Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 414.] SATURDAY, JULY 16, 1831. [Price 3*d*.

APIARY AT HORNBY CASTLE.



MR. NUTT'S BEE-SYSTEM.

Sir,—I have received several letters since my last communication to your extensively-circulated journal, calling on me to make known a little more explicitly, through the same medium, my intentions in regard to the publication of my Treatise on the Management of the Honey Bee. The writer of the last of these ("A Friend") desires I will state how many subscribers will suffice, and also, whether in the event of the requisite number not being obtained, I would be content to take a sum for the manuscript. I need scarcely say, Sir, that I have no intention of disposing of the manuscript for the private benefit of any one individual; but as soon as my subscription list contains 500 names, and the money is paid to any of the gentlemen named at the close of this letter, I will send it to press and print a thousand copies, for the use of the subscribers and the public at large. I have already obtained 225 subscribers, so that only 275 more are required. Every person who has purchased any of my hives is entitled, in the meanwhile, (always paying the postage of his letters) to the fullest information respecting my Apiarian plans

So many of my hives are now in use in different parts of England, that the manner of their construction can no longer be considered a secret; and to that extent merely, I can have no objection to give at once every explanation in my power. I desire only that it may be kept in mind, that much more than a knowledge of the right mode of construction, is necessary to him who would realize the full benefits of my system; for, as more than one piratical imitator has proved to his cost, it is not the machine which works the bees, but the bees that work the machine.

The first of the accompanying sketches* gives a general view of an Apiary, which I have constructed for her Grace the Duchess of Leeds, at Hornby Castle in Yorkshire. The second exhibits, in detail, the construction of a single hive. A is what I call the pavilion—B the elevation glass—C the communication boxes—D the dividing slides—E the ventilators—F the contributors—G the feeder—H the octagon—III the windows—1, 2, 3, and 4, tin slides, which cut off any communication between the pavilion, and the several necessary drawers, glasses, &c., &c., &c.

The pavilion, A, is first stocked by a community of bees. The slides, D, and also the tin slide under B marked 1, are kept closed until the bees nearly fill the box A. As soon as any symptoms of swarming present themselves, the natural inference must be that more room is wanted; you should then draw out the tin slide beneath the bell-glass marked 1, which will immediately throw open a new room, or chamber which the bees will not be slow in occupying, and filling with their sweets. If at the same time, either of the collateral slides, D, are drawn up, it will be found that the bees will refuse to go up into the glass, and continue their labours in the collateral box, in preference to the elevated glass. Instead of carrying the produce of their industry into the garret, they wisely prefer the more convenient store-room offered to them on the lower floor. I have ascertained this to be a general law of their economy by more than a thousand observations and trials. Year after year, I have put the matter to the test of experiment, and the result has been always the same.

To provide a place of privacy for the queen bee, is a point of the first importance. And why? Because she requires seclusion and quiet to carry on the work of propagation; like the birds of the field, she will not propagate whilst immediately under the eye and controul of man. She accordingly invariably prefers the middle box to any of the side ones, or the glass, for her royal abode. She is doubtless also influenced in her choice, by the circumstance of its being the warmest part of the hive. The atmospheric air, which enters by the cylindrical ventilators, E, cools the temperature of side boxes so much, that they are not in the condition nature requires to bring the young larvæ to perfection; though, at the same time, they are warm enough to form most desirable store-rooms for the treasured sweets of the community.

By this mode of management, all necessity for swarming is entirely avoided,

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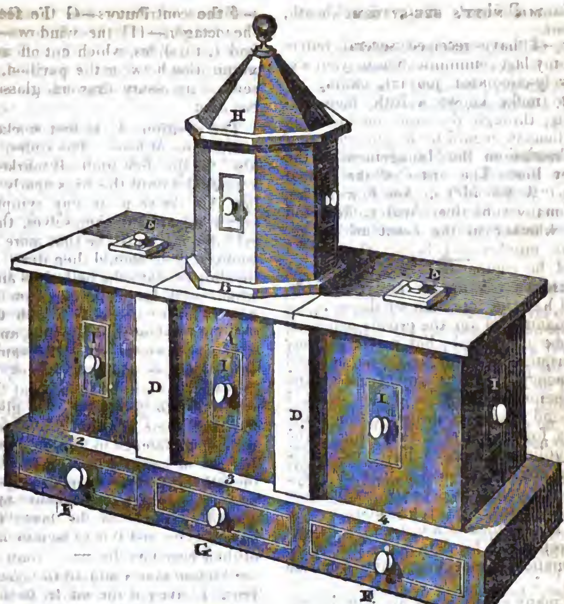
* See preceding page.



and the fullest scope given to the industry of this wonderful insect.

> "To works of nature join the works of man,
> To show by art improved what nature can.
> Nature's great efforts can no further tend;
> Here fixed her pillars, all her labours end."
>
> *Dryden.*

There is nothing of the driving, forcing, or destroying system in my practice. It rests on a liberal principle of cultivation, of which the bases are charity and humanity. The indefatigable labours of these noble insects ought to soften our feelings, and to make us more regardful of their well being. They yield us all their treasures—why should we exact the sacrifice of their lives also? Wherefore lay the axe to the tree that produces such good fruit? Is it not better to gather while we may, from its branches, and let the root live? It is not the least striking characteristic of my hives, that you can by a single touch immediately separate any part of the produce—even in the most vigorous time of the gathering season—without either danger or inconvenience to the operator.

I remain, with many thanks for the very honourable way you have given publicity to my communications on this important subject, Sir,

Your obedient Servant,

Thomas Nutt.

Moulton Chapel, near Spalding,
Lincolnshire, July 3, 1831.

List of Gentlemen who have kindly undertaken to receive subscriptions for Mr. Nutt's intended work.

The Rev. T. Skipworth, Belton Rectory, Isle of Exholme.

The Rev. C. Townley, Vicarage-house, Little Abington, near Cambridge.

The Rev. J. B. Smith, Herncastle, Lincolnshire.

The Rev. T. Clarke, Gedney Hill, Lincolnshire.

Mr. J. D. Salmon, Stokeferry, Norfolk.

William Bridges, Esq., Blackheath, Kent.
Mr. F. Gilbert, Stationer, Spalding.
Mr. S. Ridge, Stationer, Newark.
Mr. S. Ridge, Stationer, Grantham.
Mr. J. Dickinson, Silversmith, Boston.

Subscriptions may be also sent to the author himself, at the National Repository, Royal Mews, Charing Cross, London; or at his Apiary, Moulton Chapel, near Spalding, Lincolnshire.

◆

BEECHEY'S VOYAGE TO THE PACIFIC.*

Two large quartos (and there is to be an appendix of another big volume or so besides) are almost too much to inflict upon the public on the subject of a voyage of no very extraordinary interest, and in which no important discoveries—indeed, no discoveries at all—were made. We do not know which is the better system—the old one of the Dampiers and Rogerses, who saw all the wonders of the world, and were able to bring home but a scanty account of them—or that of our modern accomplished navigators, who, with their pens behind their ears, and their pencils in "the hand of a ready sketcher," take note of even the minutest occurrence, and can elaborate a thumping book on a voyage to the Isle of Man. Not that we mean to assert, that Captain Beechey's work is totally destitute of novelty or information—all that we mean to hint is, that the said novelty and information had better have been compressed into the modest dimensions of a moderate octavo, than dilated into *two* enormous heavy quartos, especially as the plates could have borne without injury a reduction to half their present inconvenient size, and the purchasers would not have grumbled to pay half the present inconvenient price.

Captain Beechey (a son, we believe, of the veteran R. A.) was dispatched in the Blossom, in May, 1825, to the Pacific, to render what assistance might be necessary to one of the numberless Polar Expeditions of Parry and Franklin. As *they* failed, *he* of course had to return as wise as he went—with regard to the prime object of his voyage—but with some very interesting additions to our stock of information on that very interesting subject, the islands of the Southern Ocean. As we observed† when reviewing Cooley's Maritime and Inland Discovery, Captain B. has given many further and later particulars of the half-European colonists of Pitcairn's Island than are derivable from any other source. Indeed, his notices of this island and its inhabitants (the descendants of the mutineers of the Bounty) form the most attractive parts of his bulky volumes; and as few mechanics can have access to the work itself, we shall offer no apology for the length of our extracts from this portion.

Our navigators came in sight of the islands in the December of the first year of their voyage. They were instantly, as may be supposed, earnestly on the look-out for some indications of Adams and his colony. At length a canoe appeared in sight, and began to near the ship. The rest we shall let Captain Beechey tell in his own words:—

> "Before they ventured to take hold of the ship, they inquired if they might come on board; and upon permission being granted, they sprang up the side and shook every officer by the hand with undisguised feelings of gratification.
>
> "The activity of the young men outstripped that of old Adams, who was consequently almost the last to greet us. He was in his 65th year, and was unusually strong and active for his age, notwithstanding the inconvenience of considerable corpulency. He was dressed in a sailor's shirt and trousers, and a low-crowned hat, which he instinctively held in his hand until desired to put it on. He still retained his sailor's gait, doffing his hat and smoothing down his bald forehead whenever he was addressed by the officers.
>
> "It was the first time he had been on board a ship of war since the mutiny, and his mind naturally reverted to scenes that could not fail to produce a temporary embarrassment, heightened, perhaps, by the familiarity with which he found himself addressed by persons of a class with those whom he had been accustomed to obey. Apprehension for his safety, formed no part of his thoughts: he had received too

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* Narrative of a Voyage to the Pacific and Beering's Strait, to Co-operate with the Polar Expeditions: performed in H. M. S. Blossom, under the command of Captain F. W. Beechey, R. N. &c. in the years 1825, 26, 27, 28 Published by Authority of the Lords' Commissioners of the Admiralty. London, 1831; Colburn and Bentley; 4to. with Plates; 2 Parts (Volumes) pp. 742.

† Mech. Mag. No. 400, p. 83.

many demonstrations of the good feeling that existed towards him, both on the part of the British Government and of individuals, to entertain any alarm on that head; and as every person endeavoured to set his mind at rest, he very soon made himself at home.*

"The young men, 10 in number, were tall, robust, and healthy, with good-natured countenances, which would any where have procured them a friendly reception; and with a simplicity of manner and a fear of doing wrong, which at once prevented the possibility of giving offence. Unacquainted with the world, they asked a number of questions which would have applied better to persons with whom they had been intimate, and who had left them but a short time before, than to perfect strangers; and inquired after ships and people we had never heard of. Their dress, made up of presents which had been given them by the masters and seamen of merchant-ships, was a perfect caricature. Some had on long black coats, without any other article of dress except trousers; some shirts without coats; and others waistcoats without either; none had shoes or stockings; and only two possessed hats, neither of which seemed likely to hold long together."—P. 49--50, vol. i.

All this is very characteristic and amusing, especially the involuntary return to old and long-abandoned habits by Adams; for this, however, there might possibly be another motive—it seems he wished Captain Beechey to induce the British Government to remove the colony to some more extensive and commodious spot—for no very deep acquaintance with the doctrines of Malthus must lead to the conviction, that "population" must soon begin to "press on the means of subsistence" in an island not more than two miles in length, and from which the inhabitants have no means of removing. Adams himself, according to the note, has died in "the scene of his glory;" but, it seems, his request is about to be complied with, in the removal of the rest of the Pitcairn Islanders. Wherever they may go, they can hardly be more artless and inoffensive than in their native place.

But we are proceeding too rapidly; as yet we have only seen the natives on board the Blossom—let us now convey the officers of the Blossom on shore. Here, soon overcome by the fatigues of landing and walking to the village along a rude path among the rocks, they retire to rest:—

"We were shown to the beds prepared for us. The mattress was composed of palm-leaves, covered with native cloth; the sheets were of the same material; and we knew, by the crackling of them, that they were quite new from the loom, or beater.* The whole arrangement was extremely comfortable, and highly inviting to repose, which the freshness of the apartment, rendered cool by a free circulation of air through its sides, enabled us to enjoy without any annoyance from heat or insects. One interruption only disturbed our first sleep; it was the pleasing melody of the evening hymn, which, after the lights were put out, was chaunted by the whole family in the middle of the room. In the morning, also, we were awoke by their morning hymn, and family devotion. As we were much tired, and the sun's rays had not yet found their way through the broad opening of the apartment, we composed ourselves to rest again; and on awaking, found that all the natives were gone to their several occupations—the men to offer what assistance they could to our boats in landing, carrying burdens for the seamen, or to gather what fruits were in season. Some of the women had taken our linen to wash; those whose turn it was to cook for the day, were preparing the oven, the pig, and the yams; and we could hear, by the distant reiterated strokes of the beater, that others were engaged in the manufacture of cloth. By our bed-side had already been placed some ripe fruits; and our hats were crowned with chaplets of the fresh blossom of the nono, or flower-tree, (morinda citrifolia) which the women had gathered in the freshness of the morning dew. On looking round the apartment, though it contained several beds, we found no partition, curtain, or screens; they had not yet been considered necessary. So far, indeed, from concealment being thought of, when we were about to get up, the women, anxious to show their attention, assembled to wish us a good morning, and to inquire in what way they could best contribute to our comforts, and to present us with some little gift, which the produce of the island afforded. Many persons would have felt aukward at rising and dressing before so many pretty black-eyed damsels assembled in the centre of a spacious room; but by a littl habit we overcame this embarrassment, and found the benefit of their services in fetching water as we required it, and substituting clean linen for such as we pulled off."—P. 76.

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* "Since the MS. of this narrative was sent to press, intelligence of Adams' death has been communicated to me by our Consul at the Sandwich Islands."

* This is an instrument used for the manufacture of their cloth.

The piety of these people is extraordinary; it seems divine service is performed every Sunday, and Captain Beechey gives a rather ludicrous description of the proceedings on an occasion when he was present—when an old sailor, who has settled on the island of late years, preached or rather read a sermon, which, for the better edification of his hearers, he gave three times over! And we see by the above extract how regularly they attend to their daily prayers and praise. The cause of this deep religious feeling may be traced in the history of the mutineers of the Bounty who escaped to the island, which is given with great minuteness in the work before us. It appears that frightful massacres continually occurred, until the whole of the male Otaheitans who accompanied them were destroyed. Afterwards all the Europeans perished by assassination or drunkenness —(a vice they were enabled to practise by an accidental discovery of one of them that the ice-root afforded an ardent spirit) —except the patriarch Adams and another. These two, being naturally of a serious turn, determined to bring up the children, then all very young, in the strictest religious discipline—and hence has arisen the piety and strict morality of the Pitcairn Islanders.

The following description of the village and the plan and style of their buildings, is well worth extracting:—

"Immediately round the village are the small enclosures for fattening goats, pigs, and poultry; and beyond them, the cultivated grounds producing the banana, plaintain, melon, yam, taro, sweet potatoes, appai, tea, and cloth plant, with other useful roots, fruits, and shrubs, which extend far up the mountain and to the southward; but in this particular direction, they are excluded from the view by an immense banyan tree, two hundred paces in circumference, whose foliage and branches form of themselves a canopy impervious to the rays of the sun. Every cottage has its out-house for making cloth, its baking-house, its sty, and its poultry-house.

"Within the enclosure of palm-trees is the cemetery, where the few persons who had died on the island, together with those who met with violent deaths, are deposited. Besides the houses above mentioned, there are three or four others built upon the plantations beyond the palm-groves. One of these, situated higher up the hill than the village, belongs to Adams, who has retired from the bustle of the hamlet to a more quiet and sequestered spot, where he enjoys the advantages of an elevated situation, so desirable in warm countries: and there are four other cottages to the eastward, which belong to the Youngs and Quintals.

"All these cottages are strongly built of wood in an oblong form, and thatched with the leaves of the palm-tree, bent round the stem of the same branch, and laced horizontally to rafters, so placed as to give a proper pitch to the roofs. The greater part have an upper story, which is appropriated to sleeping, and contain[s] four beds built in the angles of the room, each sufficiently large for three or four persons to lie on. They are made of wood of the cloth-tree, and are raised eighteen inches above the floor; a mattress of palm-leaves is laid upon the planks, and above it three sheets of the cloth plant, which form an excellent substitute for linen. The lower room generally contains one or more beds, but is always used as their eating-room, and has a broad table in one part, with several stools placed round it. The floor is elevated about a foot from the ground, and, as well as the sides of the house, is made of stout plank, and not of bamboo, or stone, as stated by Captain Folger; indeed they have not a piece of bamboo on the island; nor have they any mats. The floor is a fixture, but the side boards are let into a groove in the supporters, and can be removed at pleasure, according to the state of the weather,—and the whole side may, if required, be laid open. The lower room communicates with the upper by a stout ladder in the centre, and leads up through a trap-door into the bed-room."—Pages 78 9, vol. 1.

With this transcript we must reluctantly take our leave of this part of the work, although, did our room permit, we might have continued to copy from it for some pages with equal zest. Next to this, the best part of the volume (it is facetiously called only one *volume*, although divided into two *parts*, each of sufficient magnitude to "brain an elephant") is that which relates to Otaheite and the Sandwich Islands. In touching at Otaheite and describing the country, our captain, or his writing *locum tenens*, becomes politico-economical, and thus dilates on the future prospects of the Otaheitans:—

"The country is not deficient in productions adapted to commerce. The sugar-cane grows so luxuriantly, that from two small enclosures five tons of white sugar are annually manufactured under the superintendence of an Englishman; cotton has been found to succeed very well; arrowroot of good quality is plentiful; they have some sandal-wood, and other ornamental woods suitable for furniture, and several dyes. Besides these, coffee and other grain might no doubt be grown; and they might salt down meat, which, with other articles I have not mentioned, would constitute a trade quite sufficient to procure for the inhabitants, the luxuries which are in a gradual course of introduction, and to make it desirable for merchant vessels to touch at the island. It is not from the poverty of the island, therefore, from which they are likely to feel inconvenience; but from their neglect to avail themselves of its capabilities, and employ productions to advantage."—Page 225, vol. 1.

This application of the "science of civilization" to the half-barbarous regions of the Southern Pacific, strikes us as being rather comical: it shows that Captain Beechey carried, like John Gilpin's wife, "a careful mind" to the other side of the world; but it is in vain for him to think of instructing such skilful economists as the Otaheitans—for did they not, before Malthus was dreamed of, so far see into the mysteries of over-population, as to adopt, upon occasion, the most sensible means to repress it, i. e. make away with the "surplus," and convert it into food—thus killing two birds with one stone, and avoiding the trouble and expense attendant on emigration!

Another striking extract, and we have done: talk of the *march* of intellect indeed! it absolutely sails before the wind at a hundred knots an hour! The scene, be it remembered, is the Sandwich Islands; until within half a century or so, utterly unknown to the rest of the world.

"At the period of our visit (Jan. 1827) there were in Woahoo several respectable American merchants, in whose stores were to be found all the necessary articles of American manufacture, the productions of the Chinese market, wines, and almost every article of sea-store. There were also two hotels, at which a person might board respectably for a dollar a day; two billiard rooms, one of which was the property of Boki; and ten or a dozen public-houses for retailing spirits. The houses of the chiefs were furnished with tables and chairs, and those belonging to Kahumana with silk and velvet sofas and cushions. Kahumana filled chests with the most costly silks of China, and actually expended 4,000 dollars upon the cargo of one vessel. Boki paid 3,000 dollars for a service of plate as a present for the King, notwithstanding he had other services in his possession; one of which was of expensively cut-glass from Pellatt and Green, in London.

"This progress of luxury was attended by an equally remarkable change in the civil and political arrangements of the country. At the period of our visit the king was always attended by a guard under arms; a sentinel presented his musket, when an officer entered the threshold of the royal abode; soldiers paraded the ramparts of a fort mounting 40 guns; and "all's well" was repeated throughout the town during the night. The harbour in the spring and autumn was crowded with foreign vessels, as many even as 50 having been seen there at one time; 5000 stand of arms were said to be distributed over the island; 300 men were embodied and dressed in regimentals; and the Sandwich Island flag was daily displayed by five brigs and eight schooners. The islands had already received consuls from Great Britain and the United States; had concluded treaties of alliance with them; and we have just heard that their spirit of enterprise has induced them to fit out, and dispatch an expedition to take possession of some of the islands of the New Hebrides!"—P. 417, vol. 2.

This is "progressing" with a vengeance! We suppose by this time the opera is well attended at Woahoo, and have no doubt it would be a good speculation for Paganini, to desert Europe for a while for the island of the Pacific! Seriously, this picture of life in the Sandwich Islands, has much of food in it for the philosopher—and, moreover, bears ample testimony to the superiority of Great Britain in the mechanic arts. What an association: Pellatt and Green, St. Paul's Church-yard—Woahoo—the King of the Sandwich Islands—and Hoki Boki! It takes one's breath away!

We have now glanced over the most interesting parts of Captain Beechey's big book:—the rest of it is of another calibre, although the particulars of the visit to Loo-Choo are very good. Alas! the day—our visions of the only spot on earth exempt from earthly evils, is at an end. Captain Basil Hall reported, that these happy people were ignorant of weapons of war, and of money. His brother captain convicts them of knowing one, and strongly suspects them "on the other count." Fairy-land is to be sought again.

And now for the manner of the work: our readers must have perceived, by our extracts, that the style is not very elegant, and often very incorrect; examples of bad grammar are numerous; and the narrative is often too finely-spun—verbosity is its besetting sin. As we said before, it should have been compressed to at least half its present bulk:—and it should also go through the hands of some professor of the King's English. It is never too late to mend; but, unfortunately, works of this expensive kind seldom arrive at a second edition. As to the mechanical getting-up, it is excellent, although the punctuation has been indifferently attended to: the plates are in the first style of art, and most of them, especially a portrait of old John Adams (who looks like a hearty old tar, and little more), a view or two of his picturesque island, and a view in Loo-Choo, are very striking.

MR. WOOLLGAR'S CALCULATOR.

Sir,—The extensive utility of the sliding-rule will certainly become more available to professional gentlemen and others, when Mr. Woollgar's portable calculator, mentioned in No. 405 of the Mechanics' Magazine shall be offered for sale. While I express my approbation of this new arrangement, I must say it would have been more acceptable to myself and a large class of calculators, if the properties of the Soho rule were combined; but, as this would require 3 scales of single radius to act with one of double radius, probably so desirable a combination cannot be effected without losing the chief object in view—portability. I am however of opinion, that the 12-inch Soho rule may, by means of a folding-joint in the middle, and cutting the slide at the division of the two radii, be reduced to a 6-inch length, abandoning the joint in the present rule, by which it is extended from 12 to 24 inches, and keeping the stock in two pieces, each 6 inches by 1⅝, which will afford the usual space for tabular divisors. Then on the other side, in lieu of inches and their subdivisions, which may be placed on one edge, I would have an inverted slide of single radius, broken at 3, to work in the other grooves when required, and fill up the remaining space, except about a square inch, with a table of select specific gravities; this square inch the owner may appropriate to some particular divisors or gauge-points; it would be a suitable space for the owner's name, and, if left open, useful for a pencil memorandum, &c.

Yours, &c. J. H.

Manchester, July 3, 1831.

TEST FOR LEAD.

Sir,—I am not aware of any method, sufficiently ready for practical purposes, by which the "Manufacturer," who addresses you on the employment of prussiate of potass, as a test for the presence of lead (p. 271, of your present volume), can distinguish a precipitate of lead from one of tin. I would recommend to him to abandon the use of the prussiate altogether, and to have recourse to some test of greater certainty—hydriodate of zinc, for example, (formed by digesting zinc and iodine in distilled water.) What the colour of the precipitate will be when such a test is employed, and lead is present, must depend on the sort of acid predominating in the particular "compound" to which your correspondent alludes. Of this, however, he may rest assured, that it will be such a coloured precipitate as he will obtain from no other metal.—Yours, &c.

A CHEMIST AND CONSTANT READER.

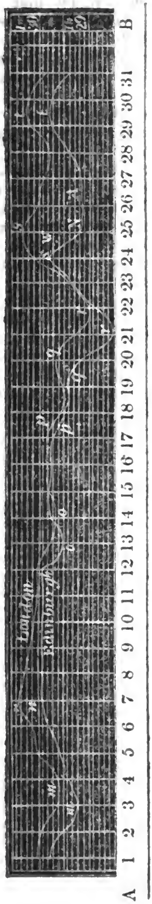
London, July 5, 1831.

SKETCH OF AN IMPROVED SYSTEM OF METEOROLOGICAL OBSERVATIONS, WITH A DESCRIPTION OF TWO NEW METEOROLOGICAL INSTRUMENTS.

(Continued from last Number.)

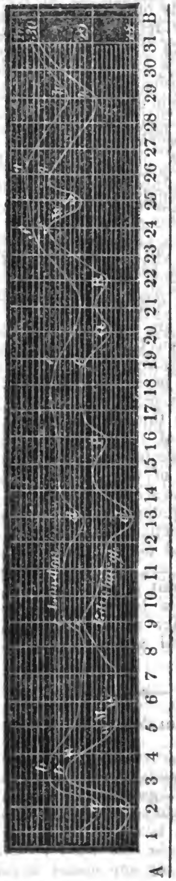
BAROMETRICAL CHARTS.—October 1806.

No. 1.



December 1806.

No. 2.



13. Another way in which this system may be employed is in comparing the state of the atmosphere at different places during any part of the year. As a partial example of this, we give the above barometrical charts, which may likewise serve, in a small degree, to display the spirit of the system we have above recommended. No. 1 shows the varying height of the barometer throughout the month of October, 1806, and No. 2, the same for December, 1806, in London and Edinburgh; the former extracted from the Royal Society's Transactions, the latter from a private journal. The vertical parallels, 1, 2, 3, &c. placed at equal distances along the base line AB, represent the days of the month; whilst the horizontal parallels, 29, 30, represent the inch-scale at the top of the common barometer. These lines, simply constructed in the manner described in § 9, gives a complete view of the fluctuations of the mercury during those months; and we are now enabled at once to observe a number of interesting particulars, such as:—1st. In No. 1, the general contour of the curve at Edinburgh and London is similar, the points *m*, *m*, *n*, *n*, &c. having a similar relation to each other in both; thus showing that the same general changes in atmospherical density when extended simultaneously over the whole island. 2nd. In No. 2, there is likewise a marked resemblance between the two curves, as at the points *aa*, *bb*, *cc*. There are, however, greater discrepancies in this month than in the former, more particularly at the points *p*, *q*, *r*, *s*; and we find, accordingly, on consulting the journal, that the weather in Edinburgh was extremely inconstant during the last 15 days. 3. We find in both charts that the mercury stands generally lower at Edinburgh than London. This is more particularly the case when changes are great or sudden; when, on the contrary, as at *o*, *p*, *q*, the mercury is undisturbed, the heights at both places are nearly equal, and the curves cross. 4. The greater the relative difference between the London and Edinburgh curves, as at P, Q, R, S, No. 2, the shorter time does it last; whilst at M, N, &c. where the duration is less, it is 3 or 4 days before they resume their parallelisms. 5. On the 25th of October, there was a tremendous storm of wind in both cities from the south-west, being the same direction as the great storm of 1703; and, indeed, all the most tempestuous winds blow nearly from the same quarter. The rise of the mercury immediately previous to this storm, as shown in the chart, is very striking. On the 21st, the wind was south-east, and it gradually veered round by the east to the north; from thence during the 4 following days by west to south-west, when it blew a complete hurricane during the whole of the 25th. These changes happened nearly simultaneously in both cities; and the rise of the mercury likewise corresponds till the day of the storm, when the Edinburgh barometer fell suddenly, while that in London continued to rise. Rainy weather, however, followed immediately in the former; whilst the wind likewise changing, showed that comparatively local causes now effected the change, whereas in the former they appear to be general and extensive. The atmosphere over Great Britain had suffered a rapid condensation from the approach of the impetuous current, giving rise to a corresponding rise in the mercury. On the 4th, 5th, and 25th of December, like storms of wind happened, similar in every respect to that of October, excepting that those on the 4th and 5th were not so furious, and we perceive accordingly that in chart 2 the curve lines immediately previous to that date exhibit the same relative changes. A number of other examples developed in this manner appear to authorize the conclusion, that before every high wind there is a continuous rise of the barometer for 3 or 4 days. This rate is, however, not without exceptions; it seems to depend greatly upon its direction, not being applicable in every case except to the south-west and north-east. Now, the former is by far the most frequent wind all over the kingdom, and is caused by the western equatorial currents reflected from the heights of America, and the latter by the polar current combined with the rotation of the earth; they are, therefore, of great extent; and thus we may perhaps infer that the above-mentioned changes in the barometer only happen when the wind is not local, but extends over a wide range of country.

14. These are comparatively few of the many interesting relations which would thus be brought into view if this system were prosecuted to its full extent. Let us suppose, for example, that during one month a complete and continuous meteorological journal were kept at two places 50 or 100 miles distant, and that these were delineated by curve lines; we would thus have 5 durable curves, corresponding to the indications of the atmometer, barometer, &c.; these compared together by 21, 31, &c. would afford many opportunities for discovering innumerable curious facts and general laws (vid. § 12.) Were we possessed of such journals for any one period, collected at different places throughout the country, we could with the greatest facility con-

struct maps in the manner formerly explained for any number of consecutive intervals. Thus combining every artifice, and taking advantage of every different modification of the system, we would be enabled to represent the varying changes of atmosphere during any period of time and over any extent of country.

15. It has been proposed, in a scientific periodical, to collect from different parts of the country an exact account of the appearance of the sky throughout one day. If the day were fixed upon, and numerous observers throughout the island were to undertake to observe the sky and clouds every half hour, sufficient materials might perhaps be thus collected to form 24 maps, showing the situation and extent of masses of clouds over the whole island at each time of observation. By inserting, likewise, the direction and intensity of the wind on each (vid. § 4), we would be enabled to discover under what circumstances clouds were formed, and precipitated as rain, their motion and changes, their attraction to mountains, &c.; with other interesting particulars, which might finally lead to an extension of our knowledge of electricity, its relation to clouds, and the formation of the hollow capsular particles of which they consist. All these have been as yet but partially and imperfectly explained; and this department of science is capable of being much improved and enlarged. May not such a design be actually put into execution?

(To be continued in our next.)

◆

WATER-WORKS AT LYNN REGIS.

Sir,—In consequence of the suggestions of Mr. Baddeley, p. 296, it may be necessary to state, that the greatest pressure on the mains in the Lynn water-works is equal to a column of water of about 58 feet in height. This is the maximum force exerted on the mains when the engine is *in general working order*. But as this town is, as I before observed, nearly a dead level, and the houses are nearly, if not all of them, less elevated than the cistern, this force is therefore sufficient to produce a plentiful supply of water on all occasions sufficient to work a dozen fire-engines.

But if a greater force is required to be exerted on the mains than is produced by the pressure of the water in the cistern, the Lynn water-works are so constructed as to produce that effect when required. The communication between the pump-boxes, and the cistern at the top of the building, is cut off by means of a *stop-valve* provided for that purpose. The whole force of the engine is then exerted on the mains, the pressure on which is of course equal to the maximum power of the engine.

I beg to observe, that where water can be obtained, the higher the situation the more desirable for erecting water-works; or, at all events, that the cistern is sufficiently elevated to produce any requisite force on the mains, without increasing the power of the engine beyond what is required to supply the cistern. For, if the water has to be conveyed to an elevation *above the cistern*, it is evident that it can only be effected by the engine; in which case it is necessary to cut off the communication with the cistern by means of a *stop-valve*, as before observed. But then the supply of water from the cistern (in case of fires) to all buildings so elevated would be of no use whatever; and, as I before observed, many buildings might be destroyed before the steam could be got up, and the engine set to work. Hence the necessity of the cistern being more elevated than any point to which the water may want to be conveyed is, I think, sufficiently evident.

My remarks on the syphon, p. 258, were independent of the atmospheric pressure, although not so expressed at the time. If, however, the shorter leg exceeds 33 feet in altitude, the water will not issue from the longer leg, whatever its length may be. That such public works in the British metropolis should be constructed on such a fallacious principle, affords matter for curious reflection. There must surely have been some other object in view very different from that of deriving advantage from merely forcing the water up one leg of a syphon and down the other. All that is gained by this plan being *a loss of friction*, as Mr. Baddeley justly observes,—"the unnecessary friction of upwards of 80 feet of pipe!"

In regard to the *cost of erection*, it may be observed, that if a cistern is placed at the top of the building, *two* pipes are required. The pipe D in Mr. Baddeley's plan may be dispensed with, as a *stop-*

valve in the pipe E, similar to that in the Lynn works, will answer the same purpose as if both pipes were retained.

Yours, &c. J. UTTING.

Lynn Regis, July 11, 1831.

P. S.—I made the plan of the Lynn water-works from a scale of 15 feet to an inch.

◆

PROCESS OF POLISHING GLASS.

Sir,—Whether it be that there is something in the business of the practical optician that renders it more than usually difficult of explanation by writing, or that those who have written upon it have not been sufficiently masters of their subject, I have never yet met with a book on this branch of art which did not fall short of explaining many most essential points of practice. I am not surprised, therefore, to see an inquiry, addressed to you from Oxford, for information on the subject (vol. xv. p. 271.) Neither am I prepared to deny the truth of the editorial remark, you have been pleased to add, that were we to judge from the specimens of bad polishing with which the shops of London abound, we must conclude that the art of glass polishing is not much better known in town than in country. You will permit me, however, to observe, that to ascribe to London workmen all the specimens of bad workmanship to be found in the shops of London opticians, would be to do them a great injustice. I believe that more skilful workers in glass are to be found no where than in this metropolis. But it is a matter of notoriety that strangers and interlopers have always more than divided with the native workmen the supply of the shops. The common Italian trampers have, from the first, had an entire monopoly of the weather-glass department; and latterly the Birmingham and Sheffield people have been doing a great stroke of business in the spectacle line. Large quantities of eye-glasses are imported into London from the north, (under the general name of *crown glass*) which, though they have a very finished appearance, are found, on examination, to be ground convex on one side only, and to be thus wholly unfit for accurate vision. Being sold cheap, however, they find ready customers among the poorer classes of people; but few of whom are able to detect the cheat that is played upon them. These glasses are ground and polished by machinery—and so also is now almost every sort of glass for ordinary purposes; but it is worthy of observation, that no machine has been yet devised that can produce a good object-glass for an astronomical telescope. It is found that the human hand alone is capable of the variety and delicacy of motion requisite to give an object-glass its exact form and due polish. Let not the reader, however, be betrayed by this remark into giving credence to such absurd pretensions as the following anecdote will illustrate. Some years ago, a friend of mine called on a certain maker of "Patent Spectacles," about which a great stir was made at the time, and for which just four times the ordinary price was charged. "Pray, Sir," said my friend, "in what consists the difference between your patent glasses and the common ones."—"Difference, Sir! oh, all the difference in the world. The common glasses you must know, Sir, are ground in a heap in a sort of bowl, while mine are ground singly."—"And that is all the difference?"—"Yes, all." —"Then, Sir, I may as well save the money I meant to spend with you, for you must know, or at least you ought to know, that all spectacle-glasses are the better for being ground in a quantity together, as each helps to give the true form to the other." Notwithstanding the emptiness of this man's pretensions, I have heard that he made a good fortune by his "patent," and that the delusion is even now carried on, though not to so profitable an extent by his successor.

But, to return to your Oxford correspondent, Mr. Lawson;—he will please be informed, that glass for optical purposes —to which he seems particularly to allude—is polished in various ways. The usual way is to polish with felt or lap, as it is called; sometimes woollen superfine cloth is employed; at others, sarsenet; but the best polisher of all is one of pitch, though perhaps the most difficult of use.

A most important thing to be attended to is, that the glass shall be properly smoothed. This is done by flour emery, which for this purpose is washed, and divided into six different degrees of fineness; the first is allowed to settle one minute, the second two minutes, and so on to the last, which may settle for an hour or two. The glass cannot be smoothed too fine in order to obtain a quick polish, which is desirable in all cases where accuracy is required, but more especially for the object-glasses of telescopes.

The *polisher* should correspond exactly in spherical form with the grinding-tool on which the glass is smoothed. With respect to the motion or stroke made by the hand, it must be that of an ellipsis. In some cases, however, it is required to have recourse to a cross-stroke in a direct line, in order to affect the centre of the glass if it be a convex one; and in others to a circular motion, to affect the outer edge, where that is needful. The case is the reverse with regard to concave lenses.

The composition in general use for polishing is the oxide of tin, or, as it is more commonly called, putty. Some use the oxide of iron, or Tripoli powder.

Yours, &c. J. SMITH.

17, Bath-place, New-road.

PRINCIPLES OF LOCOMOTION.

Sir,—My theory of locomotion being new, is a fair reason for superficial observers doubting its truth and disbelieving it. I wish the Society of Civil Engineers would examine it.

I have several times had occasion to notice the circumstance of a man attempting to lift himself off the ground in a basket. The disciples of this basket school of motion are not few: I notice some in your Magazine, see P. H. G., page 423, vol. 13, and "Practicus," page 176, vol. 14. I have encountered several, one of whom has been incautious enough to take out a patent for his basket! and your correspondent, Mr. George Chapman, No. 411, p. 251, is another of the number.

Before he had condemned anything as a "delusion," he should have taken pains to prove that his own ideas were not a delusion. He says, "Saxula has totally overlooked this upward pressure." Certainly, if there be such a thing in locomotive action, as upward pressure, not counteracted by downward pressure, my theory is wrong. It is well known, and shewn in daily practice, that it is immaterial whether the cylinders be placed in an upright, horizontal, or diagonal position on the carriage. Suppose, for the sake of my argument, that the cylinders be placed horizontally, where then is the upward pressure? Or, suppose the carriage be propelled by open-topped cylinders, without lids, and with vibrating beams on the atmosperic principle, where is then the upward pressure against the "lid of the cylinder?" If there were really any effective direct upward pressure, it must, of course, lift part of the weight of the machine off the ground, like as Mr. Chapman's left hand lifted part of the weight of the wheel, when he applied it to the centre G, whilst he was standing on the ground; had he stood on the carriage, he could not have lifted the wheel so. And if there be direct effective upward pressure, to lift part of the weight of the machine off the ground, an increase of that pressure would lift the whole of the machine off, and it would float in the air, or fly, which Mr. Chapman himself, would, perhaps, consider as carrying his principle too far into the regions of impossibility. In fine, I believe there is not any such effective upward pressure as he mentions, and it behoves Mr. Chapman to prove its existence before he assumes it to overthrow my theory, which I think will endure a refining furnace of close investigation, hotter than any of his furnaces for brass and iron, and shine brightest at last. Though I hope I shall never be loth to acknowledge my error, as soon as I can be made to see it. My theory and experiments have cost me many year's pains and study, and if the theory be erroneous, the sooner I save farther trouble the better, for I am still pursuing it.

Your correspondent, G. M., of Birmingham, page 256, says he is "no mathematical calculator;" had he been one, he would have found, by examining my theory, that it is *possible* to pass a carriage over a bar, 10 inches thick, by the power of one man. The old mechanical laws have settled, 1000 years ago, what a certain power can lift at a certain speed: neither G. M. nor Saxula can make it do more. The difficulty and curiosity lay in going over an inch bar with a common wheel-barrow, not in doing it with a purposely-constructed machine.

Yours, &c. SAXULA.

July 5, 1831.

P.S.—You have inserted, at page 247, only the last half of my reply to B. C.—

the first was on the sheet with my letter in answer to Mr. Herapath, &c.; but enough has been said on the subject, if B. C. will excuse its omission. The Journeyman Mechanic's machine, p. 249, could not work, having only the force of a fall of water from H. to B.

S.

[The omission of the first part of Saxula's reply to B. C., was the result of an oversight; arising, as he rightly conjectures, from the circumstance of its having been written on the back of another communication on a different subject. We should have been glad now to remedy the omission; but the manuscript has been unfortunately destroyed. EDIT. M. M.]

◆

ON A MORE ECONOMICAL APPLICATION OF SOLAR HEAT TO THE PURPOSES OF THE ARTS.

Sir,—I have often thought it was a great pity our government did not present Parker's Burning Glass to the Royal Society, or to the Royal Institution, instead of sending it to the Emperor of China. Its value would then have been fully appreciated; but it is now gone, and I fear it will be long before the scientific world will see another equal to it in size; for the sum of 700*l.* for a lens of 3 feet 9 inches in diameter, or even 80*l.* for a mirror 2 feet 6 inches in diameter, is like prohibiting the use of solar heat altogether.

It appears to me, that as the object is not to give a perfect image of the sun, as in the telescope, but merely to concentrate his rays, the same effects may be produced with very little expense, by increasing the aperture, and making use of the following means. Let there be two cast-iron moulds, 5 feet in diameter, turned up to the right curve, and then ground together with sand. Mirrors may then be made, by pouring glue and Spanish white on the convex mould, and covering the mixture with platina leaf, or silver leaf, (which should be mixed with a sufficient quantity of gold to prevent its tarnishing in the air), and then burnishing. Or, thin specks of copper might be hollowed nearly to the shape, and then heated red hot, and pressed between the moulds. When used, they might be rubbed with nitrate of mercury, and mercury itself. Or what would be still better, they might be made of plated copper—they would then receive a beautiful lasting polish. They may even be made of broken looking-glass, cut into the shape of trapeziums. Now, as Parker's lens gave an image of the sun, of one inch in diameter, it is probable that a mirror, 5 feet in diameter, would not give one smaller, so that the pieces might have an area of ·75 square inches. The exact proportion could be ascertained by calculation. It is obvious, there would be no advantage in cutting the pieces smaller than the solar image would be in a mirror regularly finished. The pieces should be laid close to each other on the convex mould, and a paste of glue and whiting rolled out and gently pressed on them, and dried on the mould; it could then be strengthened with iron wires, and covered with more of the composition, and put in a wood frame.

Mirrors might also be made without a mould. Make a metal or wood gauge of the right curve; then fill the frame with the composition or plaster of Paris, and work the gauge round in the same manner as plasterers work the round centres of ceilings, till the figure is completed; when dry, fix the centre piece of looking glass; place a disc of pasteboard at the intended focal distance; adjust the next piece by throwing the sun's rays on the same spot; then cover the latter piece with a disc of paper the same size. Proceed in this way, by adjusting each piece by the centre piece until complete. Or trapeziums of plate, copper, about 5 inches wide, might be pressed in a small mould, then highly burnished, and put together at the back by soldering flatted wires on them; this would form a very light and cheap arrangement; and I should think would be equal to a silver glass mirror of one half the area. By-the-bye, this would be an important experiment to try, as the pieces would naturally form themselves into the conic section, which is best adapted for a burning mirror, whether it is a circle, an ellipsis, a parabola, or an hyperbola. Another advantage attending this mode of proceeding is, that it should be made a little at a time, and used at any stage of the process, the same as Dr. Brewster's polyzonal lenses. Lastly, they might be made of speculum metal, which would be attended with the following advantages. There would be but one surface to polish; neither would there be any refracting medium to pass through twice, to stop any of the rays; there would be no anterior surface to dissipate any of them; there would be no occasion for silvering; the material is weight for weight cheaper, and more easily cast into the right form. The only objection is, that they would be heavier than glass mirrors; but probably not heavier than large glass burning lenses —they might also be made much thinner than mirrors for telescopes, as a little bending would not be of that consequence that it is in a telescope.

There has been a great deal of empiricism displayed of late, with respect to speculum metal. There is no doubt, that it is an atomic combination of two parts of copper, and one of tin; but as the tin and copper of commerce are not pure, the proper proportions must be ascertained by trial. I have made speculum metal at one melting in a common fire, and in the bowl of a tobacco pipe, without either silver, arsenic, or brass, and it exhibited all the requisites of a good metal, viz. fine colour, freedom from pores, fine fracture, and a high polishing capability.

In making a mirror for a telescope, the tools must be as large as the mirror to produce an accurate figure; but as this nicety is not required in a burning mirror, the labour may be much shortened by using tools of ½ or ¼ its diameter. I am of opinion, that the tedious process of grinding may be very much accelerated by the use of an acid. When the emery is first applied to the mirror of a telescope, the powder which is rubbed from the speculum soon cloaks up the emery, and the effect ceases; and, if there is any deep hollow, it is a very long time before the figure is perfected; but if these hollows and the outside of the mirror were varnished, and it were placed all night in a lead trough of diluted acid, and a glass grinder worked in the trough in the day-time, the metallic powder would be dissolved as soon as formed, and the emery would be left to have its full effect on the high parts, which I should think would shorten the process full one half, and there would be less danger of creasing it, at the end of the operation, by using fresh emery; as the trough would contain fine emery for this purpose.

To return to the large mirror—after it is cast and annealed, form two rough grinders of pewter, ⅓ of its diameter, by casting them on the concave surface of the speculum, and fix handles on them, so that two persons may work by moving round opposite to each other. Begin with sand or emery, varnish the hollows, and fill the concavity with diluted sulphuric and nitric acid, every night till the figure is completed. Then cement pieces of slate on the grinder's figure, the slate on the speculum by using some of the emery with the metallic powder, removed by diluted acid. The slates may then be used alone, washing the mud away with water till all creases are removed; the polishing may then be effected by covering the slates with silk, and polishing with washed jewellers' rouge and oil or pomatum.

Yours, &c. G. Dakin.

Dereham, June 23, 1831.

HINTS FOR IMPROVING STREET-PAVING.

Sir,—One of the inconveniences attending the improved system of paving recently adopted in many parts of the metropolis, is, the *smooth surface* of the pavement; which renders it unfit for the passage of horses, from the difficulty these animals experience in preserving their footing. In slight acclivities—or, even on level ground in frosty weather—the horses slip and slide about, and very frequently fall, being quite unable to find any thing like an abutment, against which they can exert their strength.

At the time Ludgate-hill was repaving, I foresaw this evil, and the following remedy suggested itself to me, and which has again been forcibly recalled to mind on witnessing the constant recurrence of accidents from this cause. I may observe, that the evil increases daily; inasmuch as the surface of the stones, which at first possessed some little roughness, becomes every day more smooth and slippery.

It occurred to me, that much of this difficulty might be obviated by bevelling the upper edges of the stones. The consequence of this alteration would be, that a series of small interstices would occur between every stone, which would afford good foot-hold for horses, without in any way destroying the level of the road, as regards the passage of wheel-carriages. The interstices would generally be filled with earth, which would retain moisture, and in some degree lessen the inconvenience arising from dust; at the same time, it would readily yield to to the pressure of the horse's foot, and afford him an excellent purchase or abutment.

I may also observe, that the iron canals or gutters, such as laid down in Fleet-street, Ludgate hill, &c., are another fruitful force of accident; from their not being sufficiently roughened—or, I should rather say, from not being roughened at all; a horse can hardly ever step on them without slipping.

Simple as the above hints may at first sight appear, yet, I flatter myself they are well worth the attention of all those who are in any way interested in the improvement of street paving.

Yours, &c. WILLIAM BADDELEY.

July 6, 1831.

CEMENT FOR FLUTE KEYS.

Sir,—In answer to your correspondent's inquiry, for the proper cement for making the leather adhere to flute keys, (p. 271) I beg to state what I have tried and found perfectly effectual. What cement is used by flute makers, I am not aware of; but more than twelve months back, I new plugged the keys of my own flute, and not one of them has yet stirred from its place. I dissolved a little sealing wax in spirits of wine, and when I had got my plugs or cushions ready, I put a drop of the solution in the bowl of the key, placed the cushion in its place, and dried off some of the moisture of the spirits of wine and sealing-wax, by holding the key for a few seconds above the flame of a candle.

Yours, &c. Δ.

LORD COCHRANE AND MR. ALEXANDER GALLOWAY V. MESSRS. BRAITHWAITE AND ERICSSON.

We are informed, by an esteemed correspondent, who was present at the trial of this case, that the Lord Chief Justice did *not*, as represented in our brief report of last week, charge the Jury to the effect that the inventions of the two parties were entirely dissimilar—that, in fact, he did not say a word to the Jury at all on the merits of the rival machines—and that the Plaintiffs were merely nonsuited on a point of law. He admits, however, that his Lordship observed incidentally in the course of the proceedings, that the compressing-valve at the end of the Plaintiff's flue (for preventing the smoke and heated vapours from escaping into the chimney), which valve forms the principal feature of their patent, had not been imitated by the Defendants. The report which we gave of the case was founded on one which we read in the Morning Chronicle, where it was said, that "Lord Tenterden was of opinion, that the condensation-valve was an essential part of the Plaintiffs' patent; and that as the Defendants had not used that means of condensation, their machine was not an infringement of the Plaintiffs' patent." We but repeated, therefore, what we found published in another respectable journal, and had not seen contradicted by either of the parties. And, after all, the difference between our correspondent's version of the matter and our own is extremely immaterial. Whether Lord Tenterden gave the opinion ascribed to him by way of solemn charge to the Jury, or only incidentally, it seems admitted on all hands that he did, at one time or other, observe that the compressing valve of the plaintiffs had not been imitated by the defendants. Now, every one who has read the numerous articles which have appeared on this case in our Magazine, must be aware, that in saying this much, his lordship did, in fact, draw as strong a line of demarcation between the two inventions as it is possible to do. The plaintiffs themselves, say in their specification (we quote from memory, but we are confident of giving the substance of their observation correctly), "When our valve is taken away, then is our furnace a furnace on the ordinary construction."

We hope to be able to lay hereafter a full and authentic report of this trial before our readers; and, when we do so, we shall probably go a little farther into the question which our correspondent has raised.

INTERIM NOTICES.

Communications received from Zeno—I. S.—A Cambridge Student—Mr. S. B. Smith—Mr. Baddeley—Δ.—N. A.—Mr. S. E. Ericsson.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-Office-court, Fleet Street.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 415.] SATURDAY, JULY 23, 1831. [Price 3d.

CLEGG'S IMPROVED GAS-METER.

Fig. 1.

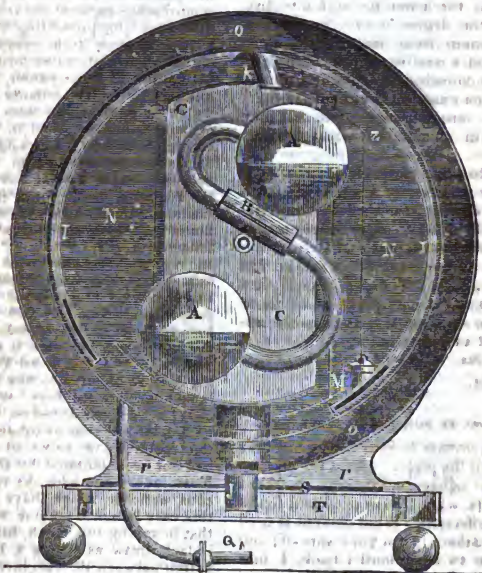


Fig. 5.

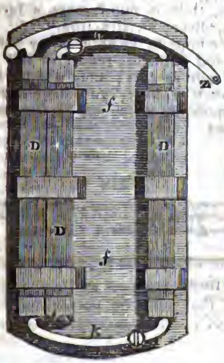
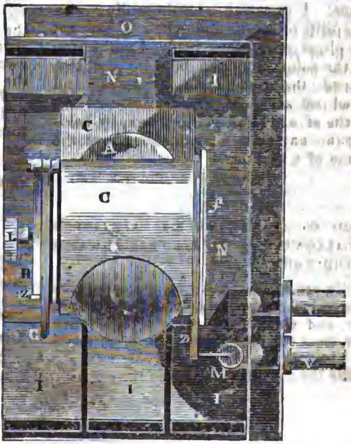


Fig. 4



CLEGG'S IMPROVED GAS-METER.

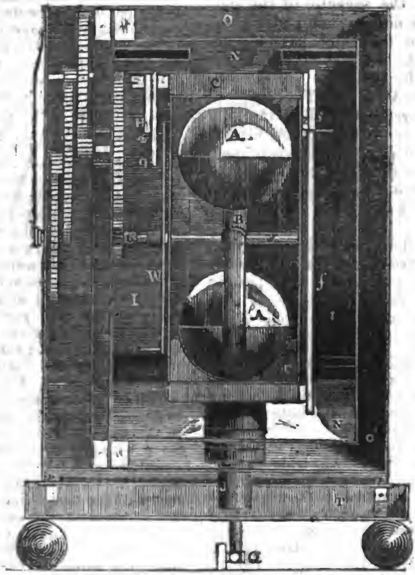
Mr. Clegg, the inventor of the gas-meter which is now in such general use, and the patent for which has only recently expired, has just taken out another patent for what he styles "*An Improved Gas-Meter.*" The original meter has answered so well in practice, under almost every variety of circumstance, that considerable curiosity must necessarily be excited, to know how the ingenious inventor has contrived to furnish us with another of still greater efficiency.

In order to show more clearly the novelty and superiority of his new meter, Mr. Clegg commences his specification by giving the following description of the old meter, in its most modern and improved form :—

"I first premise that gas-meters are machines which show by indexes pointing to numbers on dials, in the manner of the hands of a clock, what number of cubic feet of gas has passed through them, so that the proprietors of gas establishments may take the account from time to time of the quantity of gas they have manufactured or supplied to consumers—That the original gas-meter was invented by me, and formed part of a gas-apparatus, for which his late Majesty, George III. granted me his Royal Letters Patent, dated 9th December, 1815; and which gas-meter is described in my specification, dated 8th June, 1816—That since that time gas-meters have been improved in their construction by me, and by other persons, and have been brought into very extensive use—That the gas-meters now in use consist of a hollow wheel, or drum, which is mounted on pivots, so as to be capable of revolving freely on its axis; and the interior capacity of the hollow wheel is divided by partitions into chambers, which are capable of containing gas—That the said revolving-wheel is enclosed within a box, or case, containing water in its lower part; and the wheel is immersed higher than its centre in the water, so that all those chambers which are at the lower half of the wheel will be filled with water. The gas which is to be measured is introduced by a supply-pipe into the central part of the revolving-wheel, and is thence admitted by a suitable communication into one of the chambers in the lowest part of the wheel which is full of water, and which gas, by expelling the water from the said chamber, causes the wheel to turn round progressively as the gas fills the chamber; but when the chamber is so filled, the aforesaid communication between that chamber and the supply-pipe is intercepted, and a similar communication is opened from that pipe to the next succeeding chamber in the lowest part of the wheel, which chamber is full of water, in order that the said next chamber may be filled with gas in its turn. The wheel is kept continually turning round by the aforesaid influx of gas from the supply-pipe into its several chambers, one after another, gas expelling the water from those chambers, and as the wheel turns round, its several chambers which have been thus filled with gas must descend again into the water in which the lower half of the revolving-wheel is immersed; and that water entering into the chambers, displaces and empties the gas therefrom through suitable communications into the upper part of the box or case in which the revolving-wheel is enclosed, and from whence the gas passes away by a pipe to its place of destination for sale or for consumption. The quantity of gas which so passes away in any given time is determined by the number of chambers in the revolving-wheel which have been filled with gas from the supply-pipe, and emptied again into the box or case of the meter in the same, because the arrangements of the said chambers in the wheel, and of the water out of which they ascend, and into which they descend again; and also the arrangements of the various communications from the supply-pipe into the said chambers, and from those chambers into the box or case of the meter, are such as will ensure that each succeeding chamber shall be completely filled with gas from the supply-pipe before it begins to empty out that gas again into the box or case; and also that the same chamber shall afterwards be completely emptied of gas into the said box or case before it begins to fill itself again from the supply-pipe. Therefore, the number of chambers which have been so filled and emptied in a given time becomes a measure of the quantity of gas which has passed in that time. The number of turns which the revolving-wheel of the meter has made is counted, and the corresponding quantities of gas which have passed through the meter are recorded by wheel-work and revolving-indexes, similar to those of a clock."

Mr. Clegg's "Improved Gas-Meter" is altogether different from that which has been just described. It "does not work in water, and hence is not subject to the inconveniences and uncertainty of action that may be occasioned by the waste of water from evaporation or other

Fig. 2.

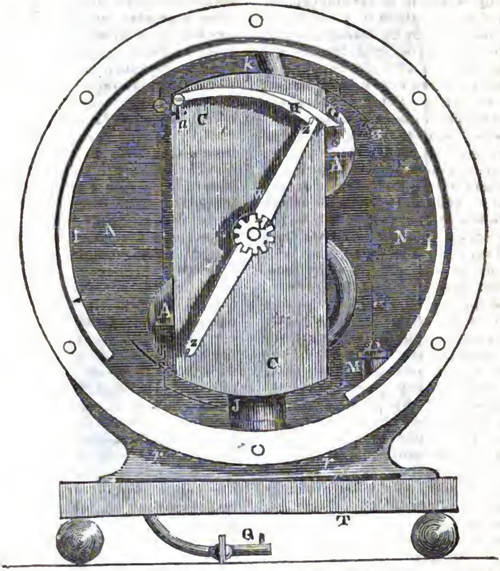


causes." And, further, "it operates without that resistance to the passage of the gas through it, which has heretofore prevented the use of gas-meters in situations where the pressure of the gas in the main pipes has been very slight."

The construction and mode of action of the new meter are thus described by the patentee:—

"The gas which is to be measured is conducted by an entrance-pipe from the place of supply into an air-tight chamber, which I call the interior of the meter, and from thence the same gas is conveyed away by another pipe to the place of its destination or consumption; so that all the gas which is to be measured must pass through the said chamber. I apply heat, by a flame of gas-light, at the outside of the lower part of the meter or chamber, so as to warm the gas which is contained in the interior as soon as that gas has entered from the supply-pipe, and before it passes away by the exit-pipe. And I place within the interior of the meter a small instrument similar to that commonly known by the name of a pulse-glass, or boiling-glass, and which consists of two hollow glass globes, connected together by a glass tube bent into the form of the letter S. These globes communicate freely by the bent tube, and their interior capacity is partly filled with alcohol, or other liquid, which boils at a low temperature; and the remaining part of that capacity is left a void space, from which the atmospheric air is exhausted and kept excluded, and consequently that space will become filled with a rare vapour, arising from the alcohol—but that vapour will be more or less rare, according to the temperature of the alcohol. This pulse glass is poised upon an horizontal axis, affixed to the bent tube in the line between the centres of the two globes, and at half way between these centres, so that the two globes may balance each other at opposite sides of the axis, and be capable of revolving freely upon the axis, and, by means of a catch, (which detains a pin at the end of a lever fixed on the said axis) one or other of the said globes is caused to stop immediately opposite to the aperture of the spout at which the cold gas is conducted from the supply-pipe into the interior of the meter, and which is situated at the top or upper part of that interior. As the pulse-glass revolves upon its axis, the two globes are caused to stop by turns in that position.

Fig. 3.



The heat arising from the small flame of gas, which is placed externally underneath the meter, is transmitted to the gas contained in the interior of the meter by means of a solid piece of copper, (or other metal of quick conducting power), which passes from the outside of the meter to the interior thereof; and thereby the temperature of the gas within the meter is so much raised above the temperature of the gas which is coming into the meter from the pipe of supply, that the elasticity of the vapour arising from the alcohol contained in the globes of the pulse-glass (and filling the exhausted spaces within these globes), will be sensibly increased beyond the elasticity that the same vapour will have when it is cooled down again to the temperature of the stream of fresh gas which is entering from the pipe of supply into the meter through the spout at the upper part thereof; and as the entering stream of colder gas blows down upon the upper globe of the pulse-glass, (which globe is detained by the catch opposite to the entrance-spout, as aforesaid), the vapour which that upper globe contains is cooled and partly condensed so as to diminish its elasticity; whilst the vapour contained in the lower globe being surrounded by the warm gas, retains its elasticity, and forces up a small portion of the liquid alcohol from the lower globe through the bent tube into the upper globe;—the heat of the surrounding gas causing more vapour to be formed in the lower globe, as fast as the alcohol passes out from it, and the cooling and condensing of the vapour in the upper globe making room therein for the alcohol, which is thus transferred from the lower globe to the upper one, until by such transfer the centre of gravity of the whole pulse-glass becomes raised above the axis on which it is poised—or, in other words, the pulse-glass becomes top-heavy, and then turns over upon its axis, or oversets, as soon as its balance is become sufficiently deranged. In so turning over, the upper globe descends, and brings that which was the lower globe up opposite to the stream of colder gas which is issuing from the spout of the supply-pipe; and in that position the pulse-glass is detained by the aforesaid catch, which always allows the pulse-glass to turn round upon its axis in moving forwards, but the catch always prevents it from moving backwards upon its axis. The cold stream of entering gas blowing down upon that upper globe, again cools and partly condenses the vapour contained therein;

whilst the vapour in the lower globe derives heat and increased elasticity from the warm gas by which it is surrounded. A fresh portion of the alcohol in the lower globe will consequently be forced up again through the bent tube, and transferred into the upper globe until the pulse glass is again rendered top heavy, and caused to overset as before. This ultimate action of the two globes occasioned in manner aforesaid, and the turning of the pulse glass upon its axis, half a revolution every time, is continually kept up so long as the gas within the interior of the meter is kept sufficiently heated above the temperature of the gas, which is entering in a stream into that interior from the pipe of supply. The pulse glass will make one of its alternations every time, that a certain quantity of gas has entered through the spout of the supply pipe into the interior of the meter, and has blown down in a cold current upon that globe which is uppermost. Therefore, the number of alternations that the pulse glass has made in any given time, becomes a measure of the quantity of gas which has flowed into the meter in the same time. The revolving motion of the pulse glass, is transmitted by a suitable train of clock-wheel work to suitable indexes, which show, on divided dials, the number of cubic feet of gas which has passed through the meter. The said clock-work and dials must be constructed suitably to the quantity of gas, which, when the meter is first set to work, is found to pass through it at each alternation of the pulse-glass; and that adjustment being correctly made, the meter will become a measure of gas in cubic feet. The pulse-glass will turn quicker or slower, according as more or less gas is passed through the meter, because the entering current of coal gas is blown with more or less rapidity upon the upper globe, so as to condense the contained vapour more or less rapidly. And in order to counteract the effects of variation of temperature in that stream of entering gas, the entrance pipe is made of thin metal in a flat form, so as to expose a considerable surface in proportion to the passage through it, and a considerable length of that thin flat pipe is coiled round within the interior of the meter, so as to be surrounded with the warm gas, contained in the interior of the meter, in order that the gas flowing through the said coils of flat pipe may derive some heat from the said warm gas, before it arrives at the spout through which it is to blow in a current upon the uppermost globe of the pulse-glass. According to the greater or lesser facility of this transfer of heat from the warm gas within the meter, to the cool stream of entering gas, the successive alternations of the pulse-glass will take place at every interval, when a greater or less quantity of cool gas has been blown down upon its uppermost globe, because a certain relation is kept up between the temperature of the warm gas contained in the meter, and the entering stream of cold gas; the latter being warmed, and the former being cooled, by the transfer of heat through the thin metal of the coils of the entrance pipe. And for the same reason, inequalities of temperature from summer or winter seasons, or from a greater or lesser flame of gas being burned beneath the meter, will not make any sensible alteration in that incoming quantity of gas, which will produce each successive alternation of the pulse-glass; and, therefore, the indexes and clock-wheel work being originally constructed, to correspond exactly with that quantity of gas which is found to pass through the meter when it is first set to work, it will continue to measure gas correctly, so long as its parts continue in repair. The heat generated by the small flame of gas, which is kept burning externally beneath the case or chamber of the meter is conducted directly up into the centre of the meter by the copper conductor before-mentioned, and the heat of the flame is insulated from contact, with the metal of which the case or chamber of the meter is formed, also from contact with the entrance pipe, through which the gas is conducted by the meter. The outside of the case or chamber of the meter should be surrounded by a suitable outer casing, or outer clothing of slow conducting substance to prevent any material waste of the heat by communication to the surrounding aid In order that the gas may be prevented from passing through the meter, when its heat is applied externally by the flame of gas beneath it, or only so little heat will not be sufficient to keep the pulse-glass in motion and operation, as aforesaid, a stop valve is fitted into the orifice of the exit-pipe, and that valve is suspended by a thermometric apparatus, which operates by the expansion of a combination of metallic bars, that expansion being accumulated and multiplied by a series of levers, from one of which the valve is suspended so as to keep open the exit passage so long as the gas within the meter continues to be at the proper temperature for the operation of the pulse-glass; but whenever the said glass becomes cooled below that temperature, the contraction and shortening of the combined bars, will be transmitted by the levers with a great multiplication of motion to the said stop-valve, so as to let it down, and stop the exit-passage of the gas out of the meter."

The better to exemplify the construction of his "Improved Gas Meter," Mr. Clegg has given a set of drawings, of one which he states he has "had in use, and found to answer the purpose of measuring gas with sufficient precision for practical use in business." Copies of these drawings we have had engraved for the illustration of the present notice. Fig. 1, is a vertical section of the meter viewed in front. Fig. 2, a vertical transverse section. Fig. 3, is an elevation of the meter with the front plate removed. Fig. 4 is a horizontal plan. And Fig. 5, is an elevation of the thermometric apparatus which opens and shuts the exit-valve. All the figures are drawn to about half the actual size of a meter, which will measure a sufficient quantity of gas to supply five lights of the kind, called Argand Burners—each consuming about 5 cubic feet of gas per hour. And the same letters of reference are used to denote the same parts in all the figures.

A A are the two glass balls of the pulse-glass; B the brass socket, by which the crooked glass tube that joins the two balls A A is fixed to the horizontal axis Y Y, on which the whole pulse-glass is poised, and about which axis the balls A A move in a circular orbit. The brass socket B is made in two halves, which are tied together about the glass tube by bands of soft wire. The axis Y is supported in pivot holes, in the sides of the metal frame CC. JJ is the piece of copper or other metal, beneath which the flame of gas is kept burning, and which conducts the heat generated by that flame to the metal of the frame CC. Q is the pipe which conveys the gas from the interior of the meter to supply the flame. N N is a cylindrical case enclosing the frame C C, and the revolving pulse-glass. The front end of this case is closed by a circular plate, screwed on by several small screws—the joint being made tight by interposing pasteboard or other suitable packing with putty. O O is an outer casing; the air between the two casings assisting to prevent the dispersion of the heat. T (Fig. 1, 2, 3) is the base on which the meter is fixed. The upper surface *r r*, is of wood with a metal plate at the bottom; the wood does not come in contact with the lower part of the base, except in the middle, where there is an aperture in the shape of an inverted funnel, to admit the heat conductor J. The feet are made of wood inserted in sockets soldered to the upper plate of the base, so that as little heat as possible may be conveyed from the base to the case of the meter. U (Fig. 4) is the entrance-pipe for the cold gas which is to be measured by the meter, and which gas is conveyed by the circuitous tube I I, to the spout K, at the top of the case N N, whence it blows down in a cold current on the uppermost globe of the pulse-glass, all as before explained in the extract which we have given from the patentee's specification. The coils of this pipe I I must not be allowed to come in contact with the frame C C; neither must the coils touch each other laterally, except at the bends of each coil by which they are united one to the other. L is a pinion fixed at one end of the axis Y, to give motion to a train of wheel-work, similar to that of the meters now in common use. Mr. Clegg gives the following instructions for proportioning this wheel-work to the quantity of gas to be registered:—

"The wheel-work must be proportioned according to actual trial, so as to indicate on the dials the true quantity in cubic feet; that is to say, if it is found on trial of an improved meter when set to work for the first time, that its dials indicate a greater quantity of gas than is proved by any other standard meter, or by a gas-holder or gasometer, to have actually passed through the improved meter, the pinion L must be changed for a smaller one, or else the toothed clock-wheel which is turned by that pinion must be changed for a larger wheel, until a correct count is obtained correspondent with the said standard meter, or gas-holder or gasometer. The said (standard) meter may be made on the present improved plan, and accurately adjusted by a gas-holder or gasometer; otherwise it may be made on what is now the common plan, derived from my former invention of chambers, in a revolving wheel half immersed in water, those chambers being filled and emptied alternately with gas."

V is the exit-pipe for the gas (after it is measured) having a stop-valve M made of ivory, which is acted on by the thermometric apparatus, (exhibited in Fig. 5,) in the manner before explained. W, Fig. 3 is a double-ended lever which is fixed to the same axis Y, as the pulse-glass, and revolves with it. At the two ends of this lever, there are two pins Z Z, and as the lever revolves, these pins come alternately in contact with a catch H, and lever G, both of which move freely on one fixed centre-pin, but quite independent of each other. The catch H, is prevented from falling too low by a stop *a*, and from being jerked up too high, by another stop at *b*—and when one of the pins Z Z passes the end of the catch H, that catch falls and prevents the pulse-glass returning, by the pin G, stopping against the end of the catch. The same pin Z, also comes in contact with a downward projecting part of the lever G, which lever is made of such a weight, that it will resist the motion of the pulse-glass so much as to require nearly all the alcohol to be discharged from the lower globe into the upper one, before the resistance can be overcome, at which instant the glass immediately oversets. While one of the pins, Z Z, thus lifts the catch H, and lever G, at one oversetting or half-revolution of the pulse-glass, the other pin answers the same purpose at the next succeeding oversetting or revolution.

The thermometric apparatus, by which the escape of the gas, without being duly measured, is prevented, is shewn in detail in Fig. 5.

"A flat plate of iron or steel *f*, is fixed to the outside of the frame C by two screws. D 1 is a bar of zinc which is a more expansible metal than that of which the plate *f* is composed; the lower end of this bar bears on a stud fixed to the plate *f*, and the upper end bears up the short end of a lever *h*, which is moveable on a centre-pin screwed into the plate *f*; the long end of the lever *h* bears down on the top end of another bar of zinc D 2, the lower end of which rests on the short end of a second lever *k*, which moves on a centre-pin screwed into the plate *f*. The long end of this lever k, bears a third bar of zinc D 3, the upper end of which bears up the short arm of a lever *z*, which is moveable about one of its ends on a centre-pin screwed into the plate *f*, while the other end of the lever *z*, suspends the stop-valve M (of the exit-pipe V) by a wire loop. When the gas within the meter is maintained by the heat of the flame burning at L, at a proper temperature for producing the revolving motion of the pulse-glass, the zinc bars D 1, D 2, D 3, will bear up the lever *z*, so much as to open the exit-valve and allow the warm measured gas to go away from the meter to the burner; but by the contraction of those bars in a greater degree than the plate *f*, to which they are fitted, they will let down the lever *z*, and the valve M, and stop the exit-pipe whenever the gas in the interior of the meter becomes cooled, below the proper temperature for producing the revolving motion of the pulse-glass."

In order that the valve M, may be lifted through more space than the zinc rods do actually elongate beyond the elongation of the iron plate *f*, to which they are attached, the centre-pins of the levers *h* and *k*, which transmit the expansion of one zinc rod to the next one, must not be placed in the middle of the lengths of these levers, but nearer to the first zinc rod in the proportion of four to one. The centre-pin of the last lever is also placed at one end in order to multiply the motion given to it by the zinc rod D 3, is about the proportion of six to one.

Should the indexes of the dials fail to register the true quantity of gas which passes through the meter, as determined by trial with a true standard meter, or a gasholder or gasometer, the following means of correction are pointed out:—

"The rapidity of action in the pulse-glass may be regulated by altering the positions of the three coils of flat pipes I I, around the inner circumference of the meter, in order that they may be placed so as to be more or less exposed to the heat radiating from the inner metal frame C C, which contains the revolving pulse-glass, and supports its horizontal axis, so that the current of gas which blows down upon the uppermost globe of the pulse-glass, may be rendered more nearly of the same temperature as that of the warm gas, within the interior meter. By this means a slower or a quicker rate of action may be given to the pulse-glass, as may be required; but what that rate will be, can only be ascertained by trial, though when once determined, it will not vary so long as the flat pipe I I retains the same position within the interior case."

Mr. Clegg calculates, that the consumption of gas requisite to keep a five-light meter on this improved plan in operation, will not exceed one 120th part of the total gas measured; and that in meters of a larger size, the proportion will be considerably less.

SKETCH OF AN IMPROVED SYSTEM OF METEOROLOGICAL OBSERVATIONS. WITH A DESCRIPTION OF TWO NEW METEOROLOGICAL INSTRUMENTS.

(*Continued from p. 315.*)

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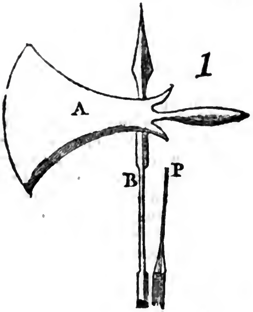

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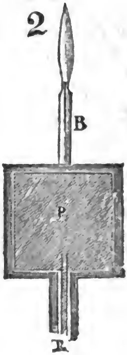

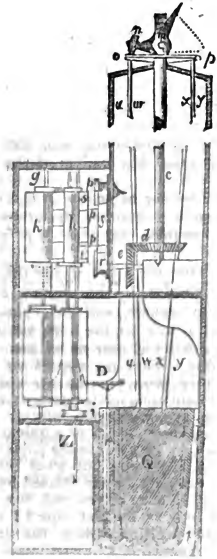

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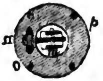

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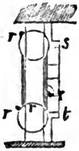

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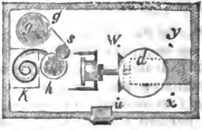

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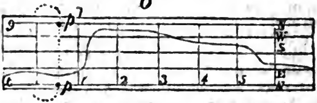

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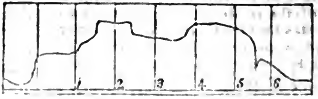


16. As a specimen of the instruments, which for continuous self-registering, would be highly desirable, we give the above design for a wind-gage or atmometer, in which, by a simple mechanical arrangement, a curve line is traced on a roll of paper by the combined motion of a clock and meteor. To arrange the principle of the barometer and thermometer, in a similar manner, we have

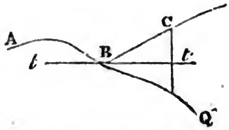
to encounter greater difficulties. The instruments would require to be considerably enlarged so that the force required to move the tracer may not destroy their accuracy. We would merely observe, that the ingenious contrivance described in page 140 of this volume of the Mechanic's Magazine, appears capable of being easily transformed into a continuous self-registering barometer, whilst Dr. Cumming's Statical Thermometer, or Kewley's Balance Thermometer, described in the Treatise on the Thermometer and Pyrometer (Library of Useful Knowledge) may likewise admit of a similar application. If such instruments were grouped together and supplied with paper, one clock movement might serve all; and thus we would be in possession of a very complete and effective meteorological instrument.

17. But although self-registering instruments would save trouble, and obviate the necessity of personal attendance at all hours of the day and of the night, yet hourly observations for any two days, taken at the same time in different parts of the country, if connected and compared together in the way above explained, would prove of the most eminent advantage, and could always be referred to as a source of the most valuable information.

18. All the use that has yet been made of the extensive series of observations already accumulated. may evidently be attained with much greater facility by this system, than by the tedious mode of comparing numerical quantities at present mostly employed. The mean influence of the moon, of particular winds and seasons on the barometer, thermometer, &c., may be directly exhibited to the eye in a manner the most simple and interesting.

19. But may we not proceed a step further? May not the power which we thus possess, of obtaining an unobstructed view of the relations of different phenomena, lead us to the resolution of the question proposed at the outset? viz.: Is it possible, from a knowledge of the fluctuations in the constitution and motions of the atmosphere during any one period, to predict the changes which are to happen in the next?

20. The causes which produce those changes may be stated generally to be the solar heat, the disposition of sea and land, and minor local circumstances. Their combined influence sustains a series of intricate motions, which are further diversified by the peculiar nature of the physical constitution of the atmosphere. Now, the latter acts quite independently of the former extraneous causes: for, if we suppose, that at one instant they entirely ceased to exert their power—the winds would not at that instant be hushed, neither would the rain cease to descend, but the change from motion to rest would be gradual, and, like the waves of the sea after a storm, the agitation would continue long after the exciting cause had vanished. This may be further illustrated, by representing the motions induced, when the active causes are in full operation by a curve A, B, C.



If at any point in this line, the power of their causes is to cease, the motions which would now continue to take place by the gradual abstraction of the accumulated influence, may be similarly illustrated by another curve, B Q, leaving AB in such a manner that they may have a common tangent B *t* at the point B.

Now, after the lapse of any time, B*t*, the change due to the absence of the stimulating causes, will be represented by C Q; which, as the line approaches B, will always become more insensible; so that, for a certain, after B we may suppose both curves to coincide with the tangent without any material inaccuracy being introduced.

21. From this we may perceive, that when endeavouring to foretel, throughout a comparatively short period, the coming changes from the past, we may altogether leave out the consideration of local causes, and likewise that the results of the experience acquired in Great Britain, may be applied with success, either in the middle of the Atlantic, or in the centre of Africa, as they depend alone upon the unvarying physical properties of an elastic medium.

These reflections, then, inasmuch as they show, that when employing the linear method of representation, it is not necessary to take notice of the vast number of particulars, which must all be minutely considered, before a complete theory of the weather is established—likewise give us reason to hope that the linear method of representation will ultimately be successful in predicting the coming changes from the past to an extent that will become extensively useful to Navigation.

Description of the Continuous Self-Registering Wind Gage.

The large vane A (Fig. 1) attached to the axle B e, communicates its motion to the bevelled horizontal wheel, which working in the vertical wheel e, and being connected with the pulley r communicates motion to the band f; to this band, the three steel points or tracers p, p, p, are fastened. The distance of the pulleys and their diameters are adjusted in relation to the diameter of the vertical wheel e, and the breadth of the paper $s\,t$, in such a manner (Figs. 4 and 6) that the instant the point p passes the line s, representing north on one side, the next point p immediately enters upon the line t, denoting the same on the other. The third tracer is fixed on the band equidistant from both, so that the length between each is exactly equal to the distance between the two north parallels st, and the whole length is thus equal to three times this distance, and three times the circumference of the pulley r. The strip of paper which receives the mark of the steel tracer is seen stretched out in Fig. 6; it is divided by horizontal parallels corresponding to the different points of the compass—when applied to the gage it is rolled on the wooden cylinder g (Fig. 5) which is fixed so as to turn stiffly round on its axis; from thence it passes over the regulating cylinder $s\,t$, the axle of which is connected with the clock movement in Z, and gives motion by the connexion of the wheels $v\,i$, to the other cylinder h, which, pressing against the former $s\,t$, draws the paper with an equable motion from g, whilst the vertical motion of the tracers on f marks out a curved line, representing continuously, by means of the parallel lines, the varying direction of the wind. The paper is afterwards collected in a roll by the tin guide k.

Velocity.—The iron plate P is connected with the rod R, moving in a vertical plane on the pivot m, fastened in the centre of the axle of the vane, which is divided into two parts as shown in Figs. 2 and 3, to admit of the iron plate moving between them. From the connection at m, the plate moves round with the vane, and thus will always be perpendicular to the direction of the wind, and will receive the full impulse of its motion. The short arm n is connected with R, and moves horizontally on the circular tract $o\,p$; this latter, by means of the 4 rods, u, w, x, y, communicates the force derived from n RP, in a vertical direction to the piston Q, which pressing on the oil contained in the cistern $a\,b$, raises in the small tube t, the float attached to the tracer D, which thus moves up and down according to the force of the wind, and describes a curved line on the paper strip (Fig. 7); this is stretched over rollers, &c., exactly in the same manner as the former, which is situated immediately above, the axles of the rollers being the same in both.

The hydrostatic principle made use of here, is applied in a similar way to the dynanometer, the motion of the piston Q being very small, when compared with that of the fluid in the tube t; thus the angular motion of P R will likewise be almost insensible; and hence the errors of inclination will be entirely avoided. The ratio of the tube to the cistern ought to allow the train D, to indicate a power of 15 lbs. on the square foot which is about the force of the wind in a storm, (see note to paper on the application of power for locomotive purposes, vol. xii., Mechanic's Magazine).

(To be concluded in our next—when will be given a Description of a Sympasometer for measuring minute changes in atmospheric pressure.]

◆

PROPOSITIONS IN NEWTON'S "APPENDIX TO EUCLID."

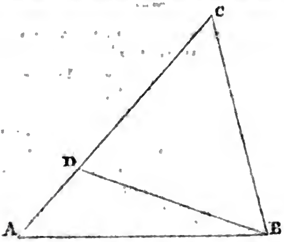
Sir,—Some time ago, you kindly inserted in your periodical a communication of mine respecting the 6th and 23rd propositions of Newton's "Appendix to Euclid." I have rested on my oars till now, in hopes that some of your correspondents would favour us with a demonstration of one or other of the said propositions. I mentioned to the proposer, that if he demonstrated the 6th, he would meet with no difficulty in the 23rd. Well, one of your correspondents (Kinclaven, I believe) blames me for not showing *how* the 23rd depends on the 6th; and the proposer, Mr. Pearce, modestly hints that I am "as much in the dark as himself." Now, in order to clear myself of these charges, both in your sight and in that of your readers, I trust you will publish what I am about to state.

I may here premise, what I have long been convinced of, that the 6th and 23rd of Newton are both *impossible* without using Euclid's 32nd. I wonder, then, how any of your correspondents (particularly your correspondent in No. 411, whose remarks in Newton's book are so full of sound sense) could prevail upon themselves to offer you the 23rd proposition of Newton without a *demonstration.* Kinclaven is particularly unfortunate in giving the most complex construction at the same time; still, I could have excused that, had it been followed by a demonstration. But, to be brief, your correspondents have yet done *nothing* to the purpose; and Mr. Pearce is left "as much in the dark" as ever.

"Give me where to stand," said the venerable Archimedes, "and I will move the earth." Of Mr. Pearce, I make a similar demand—"Give me an exact demonstration of Newton's 6th proposition, (by principles deduced from Euclid's *first six propositions*) and I will solve and *demonstrate* his 23rd." In both cases, to grant the postulate is impossible; but let the imagination get over that trifling obstacle, and the rest will follow, thus:—

Prop. 6th of Newton.

Half the difference of the base angles of a triangle is subtended by the difference of the sides containing the vertical angle.



Let ABC be the triangle, of which the angle CBA is greater than the angle CAB. Let BD be drawn, making with BA an angle equal to half the difference between CBA and CAB; then DA shall be the difference between the sides CA and CB, or, which is the same thing, CD shall be equal to CB.

GRANTED, that the proposition is strictly demonstrated, and sealed in due form with the "Q. E. D," there will follow most naturally and simply:—

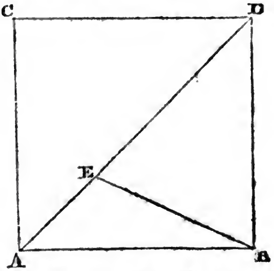
Cor. 1.—That *the exterior angle of a triangle is equal to the two interior and opposite angles.* For, since $CD = CB \therefore$ (Eucl. I. 5.) $CDB = CBD$; but $CBD = DAB + DBA$; the greater of two quantities *minus* half the difference being equal to the lesser quantity *plus* half the difference $\therefore CDB = DAB + DBA$; and the same reasoning will clearly apply to every triangle of which one side (AD) is produced.

Cor. 2.—The three interior angles of a triangle are together equal to two right angles.

This follows, as in Euclid's 32nd. If, however, it be said that it is *premature* to state that the angles BDC and BDA are = two right angles, I may leave out cor. 2, till the 13th of Euclid; but it will even then be in good time for the 23rd.

Prop. 23rd of Newton.

Given the difference between the side and diagonal of a square to construct it. Let m be the given difference, it is required to construct the square.



Construction.—Draw AB and AC of indefinite length and at right angles to each other; bisect the angle CAB by the indefinite line AD; make $AE = m$, and from the point E draw the line EB, making an angle $DEB = \frac{3}{4}$ of a right angle.

From the point B, where EB and AB intersect, raise the perpendicular BD, make $AC = AB$, and join CD; then the figure ABDC is the square required.

Demonstration.—The angle $DEB = EAB + EBA$ (cor. 1st to Newton's 6th) but $EAB = \frac{1}{2}$ of a right angle $\therefore EBA = \frac{1}{4}$ of a right angle; consequently $DBE = \frac{3}{4}$ of a right angle $= DEB \therefore DB = DE$. Again, in the triangle ABD, since B is a right angle, and $BAD = \frac{1}{2}$ of a right angle $\therefore ADB = \frac{1}{2}$ of a right angle (by cor. 2nd to Newton's 6th) $\therefore BAD = BDA$ and $AB = BD$. In comparing the triangles DAB and DAC, they are equal in every respect, (by Eucl. I. 4th) consequently the angle C is a right angle; so is D, being two halves of a right angle. The figure, therefore, has its sides all equal, and its angles right angles; hence it is square. Also, the difference between its side and diagonal is $= m$; hence it is the square required.

The construction used by me in the above problem was naturally suggested by Newton's 6th proposition. As you may observe, it is much simpler than any thing given by your correspondents, requiring only a single line EB. This, I hope, will suffice to satisfy the proposer and Kinclaven:—1st. That what I formerly stated on the subject was done on solid grounds. 2nd. That Newton's 6th is impossible without the 32nd of Euclid; the best proof of which is, that the latter is deducible from the former as corollaries; hence Euclid himself would be open to the charge of misplacing his 32nd proposition—*quod quidem absurdum est.*

Yours, &c. SAMUEL SIMPLE.

◆

SUTTON WASH BANK.

The Union coach, from Norwich to Newark, made its first passage over this new line of road on Monday, the 4th inst. with a full complement of passengers. The coach was met at the Cross Keys tavern, on the Norfolk side, (formerly the guide-house over this dangerous estuary), by several gentlemen of high respectability; it there changed horses, and continued its journey along the new bank, greeted as it proceeded by various parties of the workmen, who at the point where the bank was closed, and which unites the northern and eastern parts, had hoisted a long staff, to which was appended seven handkerchiefs in six numerals, and a pendant substitute between the seventh; thereby denoting the union of the seven great commercial towns, Liverpool, Manchester, York, Leeds, Sheffield, Birmingham, and Hull, with Norwich.

The coach was hailed, on its arrival at the Bridge tavern, by the welcome of a most numerous assemblage, among which was to be found the principal part of the rank, wealth, beauty, and respectability, of the adjacent neighbourhood. The bridge over which the coach passed was gaily decorated with numerous flags; and the shouts of the multitude, when it arrived at its destination, testified the interest they felt in witnessing the completion of a work, by which a line of road is secured over a way which, in January last, was part of the German Ocean, with a depth at high-tide of at least five fathoms water.

The day, fortunately, was fine, with a gentle south-west wind; the tide was at full; and the passengers appeared highly delighted with the beauty and novelty of the scene.

It seems almost incredible, that this ride of two miles should have been erected from the bed of the sea below, in the brief space of twenty-six weeks—a period for such a work, which is, we believe, without its parallel in the annals of labour.

The whole of the vast improvements upon the eastern coast, by which 90,000 acres will ultimately be taken from the ocean, were projected by the late Mr. Rennie, and have been executed by his successor with equal ability and success. For the preceding particulars, and also the former statement, respecting this great work, the writer has been indebted to the *Stamford Mercury.*

T. M. B.

◆

COMMENCEMENT OF STEAM-TRAVELLING IN SCOTLAND.

We are glad to observe, from the *Glasgow Evening Post* of the 16th inst., (a copy of which has been obligingly forwarded to us by a correspondent) that a locomotive steam-carriage has commenced running with success on the Glasgow and Garnkirk Railway. It is called the St. Rollox, after the name of the railway company's principal station. It made its first trip on the 14th instant and accomplished a distance of 8½ miles in 34 minutes, 4 seconds, exclusive of the time occupied in stoppages to take up passengers, which amounted to 8′ 26″. The Garnkirk Railway, like the Liverpool and Manchester one, passes for a considerable way over a moss; and of the manner in which it is here constructed, the writer of the account before us speaks in terms of high praise. "Here," he says, "an entirely new and admirable plan of (Mr. Grainger) the engineer's has been adopted for the fixing of the rails, by longitudinal sleeper beams, supported on double transverse ones, placed on beds of brush and ballasting, the success of which application is momentarily experienced, on the carriages entering on it, from the additional smoothness and agreeableness of their motion."

The carriage made a second trip on the evening of the 14th, of which the following account is given:

"On leaving the St. Rollox station, and proceeding eastward, she only reached the 3 mile post, to which there is a regular inclined plane from St. Rollox in 30 minutes; but let us calculate the load taken forward in this time, and its relative proportion on a level plane:—

	Tons.
"The engine, tender, and train of nine carriages, with passengers, was	36 50
The inclined plane, which she ascended with this load for the three miles, is regular throughout. The gravitating resistance from it was	50 · 0
	86 · 50
Friction on resistance..........	36
Total resistance on inclined plane	86 · 86

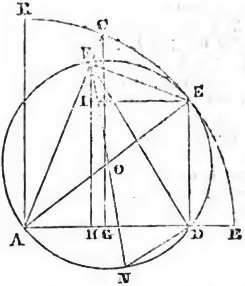
"So we see that this wonderful machine bore forward a load equal to 86 · 86 tons on a level, which is upwards of 17 times her own weight, at the rate of 10 minutes per mile! After ascending the inclined plane, we made the east end at the rate of 14 miles per hour, and returned west at the rate of 17 miles. Our load was, however, much lessened when returning."

Neither the name of the manufacturer of the engine, nor the principle followed in its construction, is mentioned.

SOLUTIONS OF MATHEMATICAL PROBLEM, NO. 4, P. 62.

QUESTION.—*If from any point in the circumference of a given sector of a circle, perpendiculars be drawn to the two radii, the straight line which joins the extremities of the perpendiculars will be a constant quantity. Demonstration required.*

Solution by G. S.



Let A B C be the given sector of a circle whose centre is A. From any point E in the circumference draw E D, E F perpendiculars to A B, A C; join F D, then will F D be an invariable quantity wherever the point E is taken. Draw C G perpendicular to A B, then because each of the angles A D E, A F E, is a right angle, the four points A D E F, are in the circumference of a circle, of which A E is a diameter.

Draw the diameter F O N, and join N D. Then the angle C A G = angle F N D, and the angle F D N = angle C G A, and A C = A E = F N ∴ F D = C G, a constant quantity. Wherefore, &c. Q. E. D.

The proposer of the question observes, with truth, that "several important trigonometrical formulæ may be deduced from the above theorem, in a simpler way than by any other method," he has ever seen.

I subjoin four fundamental deductions, from which almost an unlimited number of such formulæ may be obtained.

Deductions from the above Theorem.

1st. Calling the arc B E = A, E C = B ∴ B C = A + B. Then E D is the sine of A, and A D the cosine; E F is the sine of B, and A F the cosine; and $FD = CG = \text{sine}\,(A + B)$. Then because $ADEF$ is a quadrilateral figure inscribed in the circle $ADF \therefore AE \cdot FD$ or $AE \cdot EG = DE \cdot AF + AD \cdot FE$, and assuming $AE = 1$; then $\text{sine}\,(A + B) = \text{sine}\,A \cdot \text{cosine}\,B + \text{sine}\,B \cdot \text{cosine}\,A$.

2nd. Calling the arc $BC = A$, $CE = B \therefore BE = A - B$, draw FH, EL perpendiculars to AB, FH. Then, by similar triangles, $AC : AG :: FE : FI \therefore AC \cdot FI = AG \cdot FE$. Also, $AF : FH :: AC : CG \therefore AC \cdot FH = AF \cdot CG \therefore AC \cdot HF - AC \cdot FI$, or $AC \cdot ED = AF \cdot CG - AG \cdot FE$, that is $\text{sine}\,(A - B) = \text{sine}\,A$, $\text{cosine}\,B - \text{cosine}\,A.\ \text{sine}\,B$.

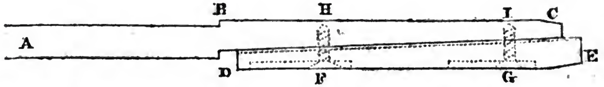
3rd. Draw AR perpendicular to AB, meeting the circumference BEC, in R. Calling $BE = A$, $CE = B$, then $BR - (BE + CE) = RC = RE - CE$. But $\text{sine}\,(RE - EC) = \text{sine}\,RE.\ \text{cosine}\,EC - \text{cosine}\,RE.\ \text{sine}\,EC$; that is, $\text{cosine}\,(A + B) = \text{cosine}\,A.\ \text{cosine}\,B - \text{sine}\,A.\ \text{sine}\,B$.

4th. The same notation remaining: let RE and CE, be taken from RB, and there remains $BE - CE$, or $A - B$. Also, $\text{sine}\,(RE + CE) = \text{sine}\,RE.\ \text{cosine}\,CE + \text{cosine}\,RE.\ \text{sine}\,CE$, that is, $\text{cosine}\,(A - B) = \text{cosine}\,A.\ \text{cosine}\,B + \text{sine}\,A.\ \text{sine}\,B$.

Yours, &c. G. S.

[Demonstrations of this theorem have been also received from Mr. Utting, W. W. F., of Kirkaldy, A. Q., and Dios; but they all fall short of that of G. S., inasmuch as they do not point out the important trigonometrical applications referred to in the postscript of the proposer.—Edit.]

IMPROVED BORING-BIT FOR GUN-BARRELS.



ABC represents a straight rod of iron, having two steel cutting edges BC, at least one-third of the length of the gun-barrel. The cutting-edges must be parallel to each other, and parallel to the axis of the tool, except at the end which enters. The back of the tool is cut away to a considerable angle with the axis, which gives it a wedge-like form. At H and I are holes for the screws F and G, which fasten the iron sliding-piece DE firmly to the tool. This sliding-piece is flat on the side that touches BC, and round on the other, the section of it being a semicircle at its widest end E, whereas the section of BC is a parallelogram. The angle of DE must be equal to that of BC; that the sides BC—DE may be parallel to each other. Two long slits are cut in the sliding-piece DE for the screws F—G, and so formed as to allow their heads to be below the surface of the bit.

I have said, that the two cutting-edges should be parallel with the back of the tool, but probably that is not the best form for the bit. I think it would cut much steadier if made somewhat smaller at the end that enters, because the hinder part of it will cut or rub off by its friction some of the metal, and leave the tool loose in the hole, which would cause it to bore untrue. Besides, a taper bit would enter much better than a parallel one.

The method of using the bit is as follows: — Loosen the screws; push the piece DE to the right hand, to lessen the diameter of it, that it may enter freely; tighten the screws, and pass the tool through the barrel. Then, by loosening the screws, and pushing DE a little to the left hand, the diameter of the bit will be enlarged, and will remove a little more of the inequality of the work. The less the sliding-piece is moved, and the oftener the tool is passed through, the truer will the barrel be. Indeed, there appears to be no limit to the accuracy of the method, as the thickness E of the wedge DE may be made in any given proportion to its length.

The dotted line along DE, next to BC, is intended to represent a groove for keeping the two pieces parallel. It is scarcely necessary, as the screws H and I effect the same thing.

Let me now contrast this tool with the present one, which is a long rod of iron, steeled at the cutting end for about 7 or 8 inches only, and worked nearly square with two cutting-edges, the opposite side being filed away a little to admit the packing of wood and paper, which forces the cutting-edges of the bit up against the barrel. The paper is put on in long slips, one at a time, (and the wood above them) as the tool is passed through. The greatest defect of this tool is the elasticity of the packing, which allows the bit to give way when it comes to any considerable inequality; and not only leaves the barrel smaller at that place than at any other, but, what is worse, the whole quantity is left on one side, not only thereby making it less in that place, but crooked also. Another defect is caused by the wearing of the piece of wood, through the roughness of the barrel, which makes the bore larger at the end that the bit is tied than the other. Besides, the whole packing being loose, it must shift about by the motion of the tool; and, to say the least, a more unmechanical method could not have been devised.

Yours, &c. W. Ettrick.

Sunderland, May 5, 1831.

N. B.—A paper, describing this tool, was forwarded to the Secretary of the Society of Arts on April 21, 1826, which was read before a Committee of the Society, but no further notice was taken of it.

SPECULA FOR REFLECTING-TELESCOPES.

Sir,—A correspondent, p. 271 of your present volume, inquires for the best method of finishing specula for reflecting-telescopes, and you promise the insertion of portions of Edwards's pamphlet on that subject, as the best hitherto published. In that, Sir, you are correct; it is by much the best treatise on the subject that has yet appeared. Nevertheless, I do not hesitate to assert, that very few, if any, could make a tolerable mirror, much less a good one, by following the directions contained in that book. Different sized mirrors require different methods of operation, but Edwards gives only one method for all sizes. For large mirrors I know it to be absolutely wrong, and I am not sure that it will answer even for the size he had particularly in view. Moreover, he gives neither the best composition for the specula, nor the best method of casting, grinding, and smoothing them, nor any rule for obtaining the parabolical figure in which the greatest defect is discoverable to a workman. In proof of these assertions it is only necessary to mention, that the best opticians, who all take Edwards for their guide, say that their methods are "uncertain, but that they can always obtain the correct figure by repeated trials." Now, what is that but saying that they have no certain rule to work by? I spent a great deal of time on the improvement of the reflecting-telescope (nearly three years), and worked ten or twelve months incessantly without being able to obtain any other than a perfect spherical mirror. The methods of Mudge and Edwards were during that time tried *several* hundred times without success, till at last my patience was completely exhausted. Experiments being found to be useless, resort was had to theory, which quickly unravelled the mystery; and in ten minutes or a quarter of an hour afterwards I possessed a 48-inch mirror, that bore 5½ inches aperture. Since that, mirrors from 1½-inch focal length, with 0·75 inches aperture power, 18 to 12 feet 6 inches, with 12½ inches aperture, have been finished, which performed, generally speaking, pretty well from the first polish, and would have done better had it not been my intention to leave them short of the parabolical figure by way of experiment. It is my intention to publish my experiments as early as possible; and my reason for making this communication is, that your pages may not be occupied by imperfect matter, which may be found in Smith's Mechanic, and various other compilations.

Yours, &c. W. Ettrick.

Sunderland, July 13, 1831.

MR. WOOLLGAR'S CALCULATOR.

Sir,—I beg to state, in reply to Mr. Andrews and J. H., that an artist is now employed under my direction in laying down the pattern for my calculating-rule.

It has been determined to increase the length to 8 inches; which will give space for more subdivisions in some parts, and greater distinctions in others, without detracting from its portability.

I had anticipated Mr. A.'s wish for the sines and tangents, which will be inserted in the portion *k*; and a mode will be pointed out of supplying the defect of the first 5° 42′ on those scales.

The use of 3 lines of double radius, in conjunction with one of single radius, is only required in solving the equation $d = \frac{b^2c}{a}$. In practice it mostly happens, that a is a constant quantity; in which cases my rule will be adequate to the solution.*

I think that many persons are led to neglect the practice of mechanical computation, from ignorance of the exactness which a well-divided instrument is capable of in expert hands. The vast number of cheap and ill-made articles which are manufactured has the effect of increasing this neglect.

Some of your readers can probably determine upon the truth of what has been reported to me, that some rule-makers do not hesitate to copy, from rules which come into their hands, any new scales that may be met with; and even to make brass patterns from such rules for their future use. It must be obvious that nothing can be more unfair or more mischievous than such a practice. No rule can be fit for calculation, unless copied directly and carefully from a pattern laid down by a dividing-engine, or by a beam-compass and standard-scale.

Yours, &c. J. W. WOOLLGAR.
London, July 16, 1831.

LIST OF NEW PATENTS GRANTED, FROM THE 22ND OF JUNE, TO THE 29TH OF JUNE.

William Godfrey Kneller, of Hackney, Esq., for certain improvements on stills, or apparatus for distilling. Six months, to specify from 29th June, 1831.

Jacob Perkins, of Fleet street, engineer, for improvements in generating steam. Six months, 2nd July, 1831.

Baron Charles Wetterstedt, of the Whitechapel-road, Middlesex, for a composition or combination of materials for sheathing, painting, or preserving, ships' bottoms, and for other purposes. Six months, July 6, 1831.

Robert Hicks, of Wimpole street, surgeon, for certain improvements in culinary apparatus. Six months, July 8, 1831.

Adolphe Jacquesson, of Leicester-square, for certain improvements in machinery or apparatus applicable to lithographic, and other printing, communicated to him by a certain foreigner resigning abroad. Six months, July 6, 1831.

Richard Prosser, of Birmingham, civil engineer, for certain improvements in manufacturing nails or tacks, for ornamenting boxes, and other articles of furniture. Two months, July 13, 1831.

John Milne, of Shaw, in the parish of Oldham, cotton-spinner, for improvements on certain instruments or machines, commonly called roving-frames and stubbing-frames, used for preparing cotton-wool for spinning. Two months, July 13, 1831.

Moses Poole, of the Patent-office, Lincoln's-inn, gentleman, for certain improvements communicated to him by a foreigner residing abroad, in steam-engines, and in propelling boats, and other floating bodies, parts of which improvements are applicable to other purposes. Six months, July 13, 1831.

Augustus Demondion, of Old Fish street-hill, London, for certain improvements (communicated to him by a foreigner residing abroad) on guns, muskets, and other fire-arms, and in cartridges to be used therewith, and in the method of priming the same; and in the machinery for making the said guns, muskets, and fire-arms, also the cartridges and priming, which improvements are also applicable to other purposes. Six months, July 13, 1831.

James Pycroft, of Rolleston, near Burton-on-Trent, gentleman, for certain improvements connected with grates, and other fire places. Six months, July 13, 1831.

Sampson Mordan, of Castle-street, East Finsbury, engineer, for certain improvements in writing and drawing pens and penholders, and in the method of using them. Two months, July 13, 1831.

William Batten, of Rochester, gentleman, for an apparatus for checking or stopping chain cables, which apparatus may be applied to other purposes. Six months, July 13, 1831.

John de Burgh, Marquis of Clanricarde, for certain improvements (communicated to him by a foreigner residing abroad) in fire arms, and in the projectiles to be used therewith. Six months, July 15, 1831.

River of Vinegar.—Near the road from Bogota to Quito, in South America, there is a river, the waters of which are as sour as vinegar. It takes its rise among the Andes, in the neighbourhood of two volcanoes, which are supposed to impart to it its sulphuric properties.

INTERIM NOTICES.

Communications received from Tom Johns—An Under-Graduate of Cambridge—Mr. Smith—Mr. Rambow—Mr. Forman—Mr. Mallet—Q.—N. A.—Hezron—I.—W. B.—A Constant Reader (of Manchester.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine office Court, Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

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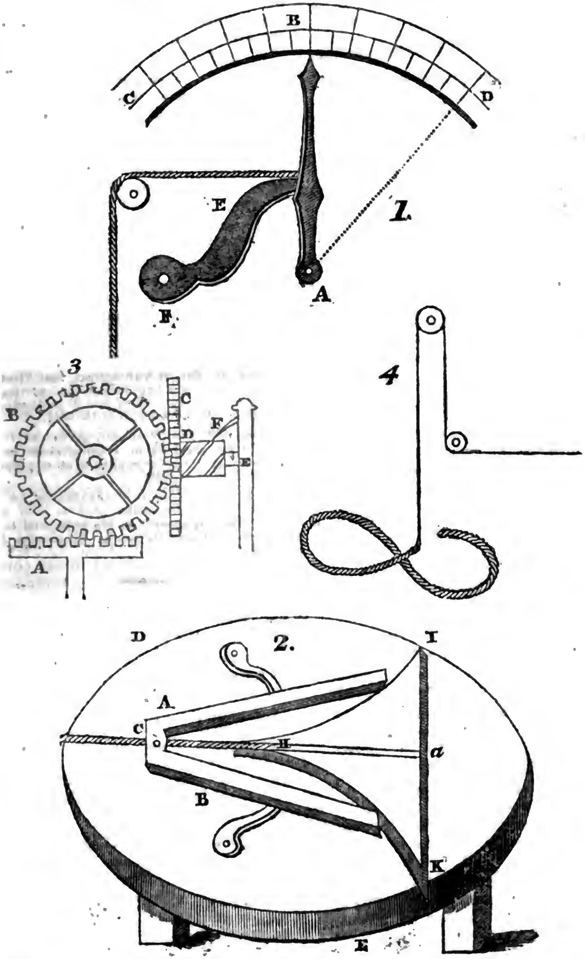
* By a substitution which is explained in one of my communications in vol. vii. of the Mechanics' Magazine.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 416.] SATURDAY, JULY 30, 1831. [Price 3*d.*

IMPROVED DYNAMOMETERS.



IMPROVED DYNAMOMETERS.

Sir,—The dynamometer is a name given to some well-known instruments, of great service in the estimation of the force of animals, either at what is called a dead pull, or in traction, assigning that force in either case; and so furnishing useful practical data to a great degree of correctness: they enable us to find comparative strength, either in different animals, or in the same animal in the various modes of its exertion, and how the power of traction becomes less as the speed increases.

The most common instrument of this kind, is that called the spring dynamometer, consisting of an elliptical spring, having a hook fixed at each extremity of its imaginary transverse diameter, to one of which the force exerted is applied, while the other is fixed; a scale is attached, by means of which that force is ascertained. The effect of a force applied in this manner, is to change the figure of the spring by increasing the transverse, and lessening the conjugate axis; the amount of this change is proportioned to the force applied; and thus it enables us to graduate the scale by trials.

Another dynamometer of a very ingenious kind, is described in vol. 11 of the Mechanics' Magazine, and, as this is before the eye of the readers of that work, it is needless to describe it here.

It may be said of these instruments, that the first is open to objection from the oscillations to which it is subject when force is applied; and though at a dead pull, the second is free from this, yet, it is probable, that in cases where the force of traction is to be measured by it, it would be rendered imperfect by the agitation of the moving vessel, disturbing the result pointed out by the surface of the mercury on the scale.

The object of this communication is to submit one or two schemes for another dynamometer.

The simplest of the plans is that represented in fig. 1. A B is an iron rod or bar moveable on an axis A, as a centre, its apex B traversing on the arc CD. E is a strong curved spring, firmly fixed upon a pin at F, and attached at its other end to a point on the bar A B. The force to be exerted is applied at a point G on the bar, either by means of a cord, as shewn in the figure, or by a hook fixed on the bar, and by overcoming the spring it causes the apex of the bar to move on the arc CD, to an extent always proportioned to the force. Let D be a point on the arc at which the spring ceases to force AB, and then, apply weights to act on it in succession, and for each of these note the position of the apex B, thus will be obtained a scale applicable to measure any power within the range of the weights.

To prevent the bar giving back when the force or tension of the chord G is relaxed, and to clear the plan of the objections which bear on the elliptical dynamometer, I should connect a horizontal rack A (fig. 3) to a point on the vertical rod A B (fig. 1) turning a wheel B by cogged work in a vertical plane, parallel to that in which the rod moves, and driving a spur wheel C in a vertical plane perpendicular to B; this, when the bar moves, gives a rotary motion to the axle CD, on which about one turn of a spiral groove is cut. E is a vertical bar, in which one extremity of the axle D revolves; to this bar is attached a click F, which takes into the thread of the spiral screw, and may obviously be so fixed as to be perpendicular to the thread in that point; and when the force is relaxed, this click will prevent the arm giving back by more than a very small quantity, and is on this account, I think, preferable here to the ordinary ratchet.

I now proceed to describe the other modification. A B (fig. 2) are two strong prismatic bars of metal equal in length, and connected by a stiffly-moving joint at C—this is firmly fixed by a pin or otherwise to a strong horizontal board or table D E; these may either be acted on by springs at G F, or they may be so by weights connected with strings fixed at the extremities of AB, crossing and going over fixed pulleys. HIK is a wedge, of which the sides H I, HK are segments of equal circles. The force to be applied, acts by a hook or cord fixed to the apex H; and in proportion to its amount draws that apex towards C, by overcoming the springs, &c. In a wedge of this kind, the degree of force required to draw the wedge onward, is constantly varying at every point of the curves in contact with A B, as is evident from the theory of the wedge. The scale must be graduated by trials, and may be laid down on one or both the arcs HK, HI, or in direction H *a* on the wedge, as denoted by the point of an index fixed by one extremity to the table, the other projecting over the line H *a*.

In figs. 1 and 2, the ratchet for the sake of simplicity is omitted; in fig. 1, the way in which it is applied has been shown, the rack may be fixed at *a* in fig. 2.

Perhaps the most simple dynamometer that can be, is shown in fig. 4, in which a cord is represented connected by one end to a chain or flexible rope, coiled on the ground, and going round fixed pulleys; it is evident that the greater the power applied at the other end of the cord, the higher will the chain or rope be raised, and thus, by trials, a scale of powers may be formed on it. This plan applied to the index A B, fig. 1, would be a good substitute for the spring C, and would evidently make a good *weighing machine.* Other dynamometers would answer this end; but, I think, none of them so well as the combination of figs. 1 and 4.

It may be right to mention, that so far as I am concerned, these plans are original, and if it be shown that they have been before known, or that they are fallacious, I expect to be told of it with the candour due to the sentiments which impel me to transmit them.

In their present shape, however, they are only theoretical speculations, and circumstances forbid me to hope that I can ever push them to the mechanical test. Possibly, however, with all their imperfections on their heads, they may prove the means of inducing others to do so; if they should, my end in making them known will be fully answered.

Yours, &c. * * *

July 12, 1831.

◆

ON THE BURSTING OF PIPES BY FROST.

Sir,—Permit me to apologise to an "Inquirer after Practical Knowledge," (p. 127) for not having furnished the information requested of me, on the subject of water-pipes; which I would have done ere this, but that the request had escaped my notice. I have observed with regret, that I have not been superseded by either of the three gentlemen, whose communications on this subject appear in your 411th Number; and I now submit the following information, with a hope that it may prove satisfactory to all parties, and escape the objections so justly raised by you to the explanations hitherto furnished.

At the outset, I would observe, that pipes are frequently *burst by frost*, but *never by a thaw.* The following passages from the Treatise on Heat, published by the Society for the Diffusion of Useful Knowledge, appears to embody so much of the information we possess on the subject, that I make no apology for transferring it to your pages verbatim.

"There are a few partial exceptions to the expansion of bodies by heat, and their contraction by cold, of which water presents the most remarkable. This fluid contracts in cooling until it arrives at a certain point, and then expands as if heat were applied. This property of water was first observed by the Florentine Academicians, in cooling a thermometer-glass, filled with water, by immersion in a mixture of ice and salt; but De Luc afterwards investigated the subject, and considered the greatest density of the water to be attained when it arrived at 40°, as it ceased to contract from that point, although the cooling process continued; on the contrary, expansion was found to result both from the addition and the abstraction of heat, after the water arrived at the above-mentioned temperature. Sir Charles Blagden and Mr. Gilpin discovered that De Luc had omitted to make the proper correction for the expansion of the glass; which, when they had done, they found that water arrives at its greatest density on being cooled to 39° of Fahrenheit. Dr. Hope considers the greatest density to be at 39° 5′; and the French chemists at 40°. Taking the temperature at which the greatest density occurs to be 40°, the density of water at 48° and 32° will be the same.

The expansive force of water on freezing is well known, as water-pipes and vessels filled with it are often burst by its force. Even in our bed-rooms, in very cold weather, water-bottles are frequently broken, if they be quite full of water, and have such narrow necks as to prevent the free expansion of the fluid in freezing. The flat stones of pavements are frequently raised out of their places by the freezing of the water beneath them, trunks of trees are split, and rocks are rent asunder by the same force. The agency of frost is very beneficial in occasioning the substance of rocks and of soils to moulder to powder, thereby fitting them better for the purposes of vegetation. A strong brass globe, the cavity of which was only one inch in diameter, was used by the Florentine Academicians, for the purpose of trying the expansive force of congelation, by which it was burst, although the force required was calculated to exceed 27,720 lbs.

"Experiments were tried by Major Williams, at Quebec, in one of which an iron plug, nearly 3 lbs. in weight, was projected from a bomb-shell to the distance of 415 feet; and in another, the shell was burst by the freezing of the water which it contained."

"Several attempts have been made to explain the expansion of water in freezing; the most plausible of which is, that given by De Mairan, who supposed that the particles when they crystallize and assume the solid state, have a tendency to unite by certain sides in preference to others, arranging themselves so as to form right lines at determinate angles. This arrangement of the particles requiring more space, and leaving numerous vacuities, the bulk of the whole must necessarily be enlarged."

The circumstance which induces many persons to suppose that pipes are burst by the thawing of ice contained in them, is in a great measure accounted for, by recollecting, that, although the pipe is actually burst by the expansion of the water in assuming the solid state, yet the rupture is not made visible so long as that state continues; and it is only upon the commencement of a thaw, that indisputable proof of the bursting is furnished. That the bursting takes place in the act of freezing, may be familiarly illustrated by the following simple experiment:—Take two or three small phials, and having filled them with water, cork them up, securing the cork with twine and cement; immerse them in a freezing mixture, (snow and salt), and they will burst at the moment the water crystallizes, as it is supposed to do, on assuming the solid state; the bottles will be found shattered to pieces—the contents solid ice.

The converse of this experiment, showing that a similar force is not exerted during the act of thawing, may also be performed. For this purpose take the phials as before, fill them nearly to the top with water, which must be suffered to freeze; the corks are then to be inserted and secured, as in the former experiment, and the ice contained in the bottles is to be gradually thawed; no breakage will in this case ensue. This experiment, however, is not quite so accurate or so satisfactory as the former; it also requires more care in its performance.

The "Inquirer after Practical Knowledge" asks, "whether it is the frost, or the force of water after the frost, which bursts the pipes?" I reply, it is sometimes one, and sometimes the other; many instances of each have fallen under my notice The foregoing remarks illustrate the effects produced by the frost; on the remaining case I will add a few words.

In the bursting of leaden pipes by the frost, the rupture is generally a long straight slit in the direction of its length; frequently as sharp and well-defined as if it had been made with a cutting instrument. In ruptures occasioned by the force of water, the lead usually expands in the form of a small bladder, becoming thinner and thinner until it at last gives way; this effect is sometimes produced by the upper part of a pipe being frozen, and consequently stopped up, while the lower part is subjected to the pressure of the water in the main, when any portion of the pipe that is faulty becomes unable to sustain the increased pressure, and bursting ensues, to the great annoyance of the proprietor.

Plumbers are occasionally in the habit of placing a cock upon the service, at its entrance to the house, which enables the housekeeper to turn off the water during the continuance of severe frosts, and so to preserve the pipes uninjured; it also affords the ready means of turning off the water, if a pipe should happen to burst in the house.

Many persons were compelled to resort to this expedient during the late severe winters; and I would recommend every person not so provided, to lose no time in obtaining this simple addition to their water-pipes, which may in a few short months be the means of protecting them from much annoyance and expense.

The ferules are forced out of the mains by the sudden shocks which are occasioned by the rapid shutting of cocks in different places, while they are under great pressure. Those who are acquainted with the principles of the hydraulic ram, will readily perceive the consequences of these repeated blows upon the mains and services, which is eventually the destruction of their connexion.

Yours, &c. WM. BADDELEY.
June 27, 1831.

Sir,—I was much surprised at the answers given by your different correspondents to the question of "An Inquirer after Practical Knowledge," (p. 127) respecting the cause of the bursting of leaden water-pipes, "after a frost," having supposed that the nature of the fact referred to was well known. It is said that Charles II., wishing to make sport with the Royal Society, at its first establishment, proposed to the Members to inquire the reason why a dead fish was so much heavier than the same fish when alive just before. Many learned essays were immediately written to prove that the thing was a matter of course, and showing the reasons why it was so; but at length it occurred to one of the disputants to verify the fact, and he soon found that the dead fish and the living one were both of the same weight! So, in this case, a thing has been assumed as a fact that has no existence in reality; for water-pipes do not burst when a thaw comes on, as is vulgarly supposed, but the rupture takes place at the time of freezing, through the force of the well-known expansion of water when turning into ice; but because the fissure remains undiscovered till the water resumes its liquid form, it has been hastily concluded (forgetting the difference between *post hoc* and *propter hoc*) that it is the thaw that causes the pipes to burst, when, in truth, the mischief has been done long before. Hence the preventive is to take care that water-pipes are not full when a frost is likely to come on.

Yours, &c. W. GREEN.
Sloane street, June 27th, 1831.

[We have received letters on the same subject from A. Z.—A Practical Plumber—A Professor of Useful Knowledge—B. T.—A. J. E.—An old Sailor—Nemo, Jun.—Mr. Utting—P. T.—Mr. F. Bailey—I. S.—Mr. Mallet, and Mr. Mackinnon; and one or two more selections from this voluminous correspondence we must lay before our readers, before offering any remarks of our own. We may mention, in the mean while, that, with a single exception all our correspondents agree with Messrs Baddeley and Green in positively denying that a disruption of pipes ever takes place from the process of thawing. The gentleman who stands alone in his view of the subject, puts a question which must, we think, disturb this unanimity of opinion a little:—"Does not ice itself frequently burst from the escape of the air contained in it (in the process of thawing, of course)? And if so, why may not a pipe containing it be also burst by that identical air?"—EDIT. M. M.]

PRACTICAL HINTS ON THE MANAGEMENT OF BEES, AND REMARKS ON MR. NUTT'S SYSTEM.

Sir,—On perusing the Mechanics' Magazine of the 18th of June last, I was particularly struck by Mr. Nutt's observations on the management of bees; having myself kept bees for nearly 15 years, and being particularly fond of them. I have tried a great many improvements—at least, what were generally considered such—but they have in the end uniformly disappointed me. Mr. Nutt's improvement being considered of great importance, it is to be regretted that the principles upon which his system is grounded, cannot be made more fully known at a less charge than ten shillings. Such a sum nine-tenths of the bee-masters, who alone keep these insects for profit, cannot afford. There are some statements of Mr. Nutt's which I cannot at present comprehend. He speaks, 1. of regulating the temperature of the hive; 2. of giving room to prevent swarming; and, 3. of the enormous produce of a single cottage-hive.

1. With regard to the first point, I would ask him what new contrivance is necessary to regulate the temperature of the hive? Has the common cottage-hive, when kept dry, ever been known to produce disease? I certainly think not. In summer, the internal air is evidently sufficiently regulated by the continual motion of the bees, and their rapid ingress and egress. In winter, if the hives are much exposed, a piece of sacking or a hay-band wrapped round each hive, effectually keeps up the necessary warmth. The comb-burning damp is certain destruction to a colony, and should therefore be carefully prevented.

2. With respect to giving the bees room to prevent swarming, it is by no means a certain preventive; for it is well known, that swarms will often come off when the hives are only half full. Swarming appears to depend entirely upon the time of the year the additional room is given. Nor would it, in fact, be advisable to prevent swarming, were it possible to do so; for every season the number of bees would be trebled in each colony, and this is an advantage which no bee-master would covet. Much has been said of the cruelty of destroying bees to procure their honey; but, in many cases, the object is more to reduce the number of stocks, than to profit by the honey and wax. Were not the hives of bees occasionally destroyed, one swarm would, in five years, upon a moderate calculation, produce eighty! What could possibly be done with such vast numbers, in many parts of the kingdom? I consider it, therefore, not only necessary, but consistent, to reduce occasionally the stock of hives, by destroying the old and light colonies—the first, because they become less vigorous and healthy; the second, because they are seldom able to live through the winter. I have generally made it a practice to destroy all weighing more than 15 or 16lbs. and less than 10lbs.

3. The enormous single cottage hive produce, mentioned by Mr. Nutt, is beyond belief. To gain 50 or 60lbs. of honey in one season from a single hive, is seldom heard of; but Mr. Nutt claims credit for four times the amount!

Many different plans of hives have been suggested; but there are very few superior, or even equal, to the common bell-shaped hive. I have tried Huish's, but generally failed, because I found it impossible to make the bees build their comb straight with the top rails; they worked more often cross-ways, thereby completely defeating the plan. I have also tried the storying system, and glass hives placed on the top; but I consider much time and labour is lost, by causing the bees to ascend into upper hives.

Last year I had six square wooden hives made of inch deal, free from turpentine, 14 inches wide by 10 high. A piece of clean glass, 5 inches by 3, is let into the top, and covered by a thin piece of wood to exclude the light. There are two door-ways, one before and another behind, 3 inches long, and 3-8ths high. Each of these I can close by means of a sliding slip of wood, 3-4ths of an inch high, and 1-8th thick; and from the centre of this sliding-door, a piece 3 inches long and 3-8ths high, is removed, to correspond with the door-way. In spring and summer I have the whole of the front entrance open, but as autumn advances, I gradually push in the sliding door, to keep the wasps from pillaging the hives; the bees being better able to guard a small than a large entrance. The hives are placed on inch boards, 33 inches long by 15 wide. Additional room is at all times very easily obtained: for I have merely to place the full hive at the end of the board, and an empty one in front, leaving both doors of the front hive open; which can, with equal ease, and probably good profit, be removed at the usual time of deprivation. Another important advantage is, that second swarms or casts can be easily put together, or a cast added to a weak swarm, it being only necessary to put the two together in the evening, and keep the end doors closed 16 or 18 hours; after which time, I find they become united, and pursue their labours as one colony. In September, the lightest of the two can be removed: all my hives are covered with a piece of sacking, over which I place damaged milk-pans.

I think there are many disadvantages attending feeding bees; they may be forgotten at the right time, or they may be disturbed unnecessarily, and exposed to destruction from cold, or to robbery by other bees. To prevent these frequent misfortunes, it is advisable to destroy in September all hives weighing more or less than 16 and 18 lbs. exclusive of the hive, which should be previously weighed and painted on the outside; 10 lbs. being too little, and more than 16 an unnecessary quantity for their support throughout the winter.

Yours, &c. G. L. S.

Enfield.

PRINCIPLES OF LOCOMOTION.—TRIUMPH STEAM-CARRIAGE.

Sir,—Although I do not belong to the scientific class (by the bye, of late grown very shy birds), to whom Saxula appeals, p. 44, vol. xv.—have never had the good fortune to see any locomotive-machinery—and have no knowledge of it but what is to be gained from the pages of the Mechanics' Magazine; yet, as a lover of free discussion, a reader, and one of the craft, I claim the right of making a few remarks on his new locomotive theory, which, if I rightly understand him, consists principally in the application of a long crank instead of a short one, from which arises the superiority that he claims for his Triumph steam-carriage; but as I well know how easy it is for any one to deceive himself when too eagerly pursuing experiments with a view to a particular conclusion, I could wish to draw his attention to what I believe to be errors that have arisen from that cause.

1st. Taking his engine, &c. at a maximum, we will suppose there is no objection to a cylinder 5½ feet long, on the score of weight or unwieldiness, still the speed of the carriage must be an insuperable bar; for stating the velocity of the piston at 220 feet per minute, the stroke of the engine, and the diameter of the wheels being both 5 feet, he could never exceed 345 feet per minute, or rather less than 4 miles an hour.

2nd. As speed is indispensable, it must be gained, and whether by a combination of levers or wheels, it will still be with a corresponding loss of power; besides which, he is encumbered with an extra weight of machinery, accompanied with increased friction: certainly he may employ an engine with a short stroke to drive the wheels with a long crank, but in so doing he applies his power at the short arm of the lever. What advantage, therefore, does he gain?

3rd. His fundamental error appears plainly in his 5th proposition, p. 44, for in too generally considering mechanical power as the effect of a weight hung on the horizontal spoke of a wheel, he loses sight of the effect that weight has as part of the load. This is obviously the case where he doubles the weight to produce the same effect at half the radius: but an engine having action and re-action within itself, the exertion of its power to produce motion, adds nothing to its weight, which may be clearly demonstrated by the man in the basket, who does not weigh one ounce more when exerting his utmost strength, than he does when sitting at ease. Again, suspending a weight, as in figs. 3 and 5, pp. 193 and 197, by greatly increasing the load on the axle, is almost as unlikely to produce motion, as a man in a carriage pushing against the axle, p. 45; but the power of an engine being applied to a crank fixed on the axle, is transferred by the spokes to the rim of the wheel, and there acts of course in the inverse proportion that the crank-arm bears to the radius of the wheel.

4th. Another great source of error has been, in considering the machine as a simple lever with its fulcrum on the road,* and I make no doubt, that between this and the weight, he will find that he has simplified until he has completely lost sight of what is really the fact, viz., that the axle of the wheel is the fulcrum on which the crank acts to produce rotary motion, which being obtained, and the load properly apportioned to give the wheels sufficient hold of the road, locomotion must necessarily ensue, although it appears to me, to be perfectly adventitious as regards any arrangement of the machinery. Saxula will find that to reach the top of an obstruction one inch high, with a crank 9 inches long, and wheel five feet diameter, the power acts through a space barely 2½ inches; but by the new theory, viz. calling the bar on the road the fulcrum, and applying the power (as in the famous wheelbarrow problem) to a wheel 20 inches diameter, it acts through the space of nine inches to gain the top of the inch bar.

In a note, p. 195, he says, "so little have experienced engineers known hitherto of the theory of locomotion, that friction, which is the great means of producing it, has been accounted the main hindrance to its success," &c. Now I never heard an experienced engineer treat of the subject—and I have heard many—who did not, on the contrary, consider a want of friction as the chief difficulty to be apprehended. The common notion has been, that the wheels would turn round, or in other words, that there would not be sufficient friction between the surfaces of the wheels and road, to give motion to any great weight. Saxula further says, "I could find many such opinions in your pages (see one in vol. 13, page 75)." Now, out of the many, this is certainly an unfortunate selection, for the article referred to is merely an account of the performances on the stone tram-way in the Commercial-road, which exhibited the great superiority of the patent cylindrical over the common dished wheels; a single horse drawing drawn with greater ease ten tons on the former, than he could draw eight tons on the latter, which waste of power is wholly attributed to the extra friction of the dished or conical wheels. The only allusion that is made to locomotion, is a casual comparison of the *friction* on edge rails and stone tram-ways; although *friction* is the term used, I should say, resistance is what was meant.

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* On stepping into a light boat, a few days since, and walking from the head to the stern, I observed that the boat was propelled forward, and on returning to the head the motion was reversed. I shall be glad to learn how Saxula would reduce this propelling power (see note, p. 45), to what order of lever, and where he would place the fulcrum?

Yours, &c.

TREBOR VALENTINE.

Derby, July 5, 1831.

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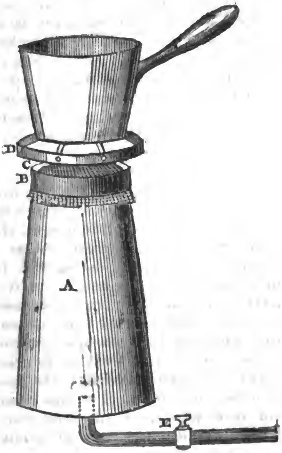
ECONOMICAL APPLICATION OF GAS AS A SOURCE OF HEAT FOR CULINARY AND OTHER DOMESTIC PURPOSES.



Sir,—I beg leave to send you a description of a simple apparatus, which I have put up, a considerable time ago, for the purpose of heating water in the butler's pantry, where there was no fire-place. It has turned out to be so useful for many purposes besides that for which it was first intended, that I hope many of your readers may find advantage in adopting some modification of it.

A is a conical tube of thin sheet iron, 12 inches high, 6 inches wide below, and 3 inches wide at the mouth.

B is a hoop of the same material, by which a piece of wire-gauze, C, is secured over the mouth of A; the joints of A and B should be hard soldered, and the hoop should fit over the wire-gauze so tight as to prevent any gas escaping from A except through the gauze.

D, a bracket or shelf, made of hoop-iron and wire, to support any vessel which is to be heated.

E, a gas-pipe and stop-cock; the jet or nozzle of the pipe to enter 2 or 3 inches within the cone.

The method of using this apparatus is as follows:—The stop-cock is to be gradually opened, while a light is held ABOVE the wire-gauze C. When the stream of gas and common air, which will rise through the gauze, has caught fire, the cock may be continued to be further opened until the flame begins to have a yellow point in the centre. This is the most advantageous state of matters, as the mixture of gas and air will then be found to burn with a faint blue flame, giving almost no light, but a very intense heat, and so free from smoky vapour, that water may be boiled over it in a bright silver vessel without dimming its lustre. If more gas be admitted than the cone is capable of furnishing a due mixture of air for, the flame becomes yellow, and deposits soot on any object presented to it.

Several of my friends have had apparatus of this kind put up in their houses for general culinary purposes, and by making the cones of different dimensions according to the degree of heat required, they are enabled to apply it to almost every operation of the kitchen, excepting roasting and baking. The comfort and neatness of such a kitchen-range will be obvious to every one; but it may require a little consideration to perceive that it must also be very economical, as instead of requiring a large coal-fire burning for hours, no gas is expended before or after the intended effect is produced, and at no time need any more be applied than is just sufficient for the purpose.

This method of burning gas affords an excellent lamp or furnace for jewellers for all purposes of soldering; it answers well also for tempering steel, as the exact degree of heat required can be given to it without scaling the surface, however long the articles may be kept hot. The best way of holding small articles in the flame is by laying them on a piece of coarse wire-gauze, which allows the heat to apply itself to every part of them. A shilling exposed in this way to a stream of gas (from a single jet-burner), will become red-hot in 50 to 60 seconds; while if held for an hour in a common flame of the same quantity of gas, it would remain blackened from the smoke without acquiring heat enough to burn it off.

Very intense heats may be obtained by a change in the arrangement of the apparatus, viz. by closing up the bottom of the cone, and making two small apertures in the bottom, into one of which the nozzle of the gas-pipe should be introduced (fitting air-tight), and into the other a similar pipe from a vessel of common air under a slight degree of compression. By this means a larger quantity of the mixture of gas and air could be burned in the same space and time, than could pass through the gauze when not impelled by pressure. This would require considerable skill in management, as small explosions might result from any mistake in the manipulation.

Yours, &c. J. R.

P. S.—I have neglected to say, that I find gauze of 45 to 50 threads in the inch answers better than either finer or coarser fabrics.

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ROOFING.

Sir,—I observe, in your 386th Number some remarks by Mr. J. Cansdell on the method of roofing communicated by me, and published in your 385th Number. I have since measured, in rather a hasty manner, the timber, and counted the slates, in the roof, (which is 41 feet wide by 93 feet long) and I find that of the former there is about 370 cubic feet, weighing about 5 tons—and of the latter, 2968 (duchesses, 24 inches by 12) weight, about 9 tons. The wood cost £31, the slates £27. 15*s*. The weight of the ridge or cross-course was about 8 cwt. 1 qr. and the price, £2. 6*s*. 6*d*. These particulars, I should imagine, must convince Mr. Cansdell that I was correct in calling it both a light and a cheap roof. I acknowledge the plan is not scientific; neither did I call it so: but the method of fixing the slates is, in my opinion, quite new. One row or set of purlins might certainly be dispensed with, and the timber used as story or king-posts, instead of the brick pillars he so much objects to. The weight and cost of the roof would then be independent of the workmanship, which would be less than usual; the weight less than 14 tons, 8 cwt. the cost of the materials about £61. 1*s*. 6*d*. It would be doing a great service to many of your country readers, if Mr. Cansdell would show them how a roof of the same dimensions can be constructed, with as small a quantity of materials, and at as little expense, on any of the more truly scientific methods to which he alludes.

Yours, &c. W. B.

Malmesbury, July 14, 1831.

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PREVENTION OF CONTAGION.

A correspondent at Kirkby Lonsdale requests we will bring under the attention of our readers certain precautionary measures, recommended by the Magistrates of Lancaster, for preventing the spread in that quarter of such contagious disorders as are now raging in foreign countries, and may by possibility find their way into our own. The measures alluded to are very judicious; and as they have not only a particular reference to the habits of the working classes, but comprehend much that is deserving of adoption in all places and under all circumstances, we have much pleasure in complying with our correspondent's request.

The Magistrates of Lancaster recommend, 1. That all factories and workshops, and all labourers' cottages, should be thoroughly white-washed. 2. That they should be well ventilated. 3. That they should be frequently swept; and the floors sprinkled with water, in which chloride of lime has been mixed. 4. That all accumulations of dust or filth in dwelling-houses, or in buildings where numbers of work people are congregated together, should be avoided as much as is possible; that the privies, in particular, be more frequently emptied than is usual, and some chloride of lime be thrown into them every day. 5. That wherever noxious vapours are apt to accumulate, as in drains, sewers, &c., chloride of lime should also be often and freely distributed. And, 6. That the work people of factories should be required to wash their hands and faces at least twice every day; to change their linen frequently; and generally to cultivate habits of personal cleanliness as much as the nature of their occupations will permit.

The chloride of lime which figures so prominently in these instructions, may be procured in a dry state from any druggist for about a penny per ounce. It is a remedy, therefore, within the reach of the very poorest. The Magistrates of Lancaster give the following directions for its use:—

"One ounce of the chloride of lime to be mixed with a quart of water and allowed to stand six or eight hours. The clear liquor to be carefully poured off, and used for sprinkling the floors of rooms, &c.; the white sediment is then to be mixed with another pint of water, and employed in purifying drains, sewers, privies, &c."

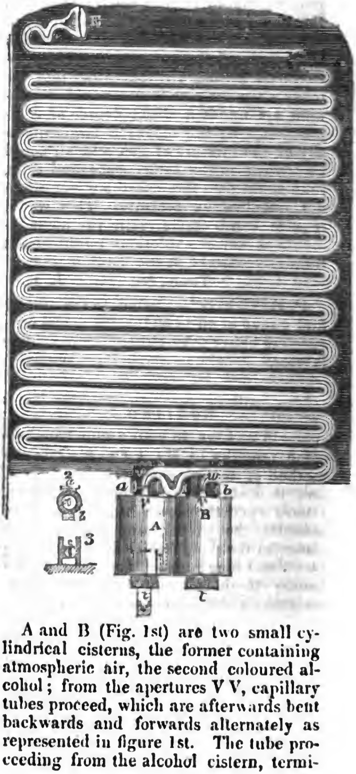
Liquid chloride of lime was first employed as a disinfectant at the Military Hospital of Strasburg in 1809; but it was several years later before its extraordinary purifying powers were fully developed and appreciated. In 1820, the Society of Encouragement of Paris, at the request of the Prefect of Seine, offered a premium for a method of obviating the injurious consequences of the putrid exhalations, attending the manufacture of catgut from animal intestines. The use of chloride of lime was proposed by M. Labarraque, an apothecary at Paris, and it was proved on trial to be a complete antidote to the evil complained of. M. Labarraque was led by the success of this particular application, to extend his experimental enquiries till he established that chlorine applied in one form or other, furnished an infallible and almost instant means of purification, in every case of an atmosphere vitiated by putrid exhalations; his labours on this subject justly entitle him to be regarded as one of the greatest of modern benefactors to humanity and the arts. Many remarkable instances of the efficacy of this remedy are on record; but none, perhaps, more convincing than the following, which is related by M. Gualtier de Claubry, in a letter to the celebrated Gay Lussac:

"Some air was blown through a quantity of blood, which had been abandoned to putrefaction during a week, and which emitted an insupportable odour. The infected air was then passed through chloride of lime, and was instantly freed from all smell and completely purified."

SKETCH OF AN IMPROVED SYSTEM OF METEOROLOGICAL OBSERVATIONS, WITH A DESCRIPTION OF TWO NEW METEOROLOGICAL INSTRUMENTS.

(Concluded from last Number.)

Description of the Sympasometer for measuring minute Changes in Atmospheric Pressure.



A and B (Fig. 1st) are two small cylindrical cisterns, the former containing atmospheric air, the second coloured alcohol; from the apertures V V, capillary tubes proceed, which are afterwards bent backwards and forwards alternately as represented in figure 1st. The tube proceeding from the alcohol cistern, terminates when it is of length sufficient to show the expansion of the enclosed fluid for 100 degrees Farenheit's scale, and then barometrically sealed as in common thermometers. The tube proceeding from the air cistern A, is to be carried up further to a height sufficient for the purpose, either of a common or mountain barometer, and may be obtained by calculation, as will be presently shown. The extremity E has free communication with the atmosphere; but a division is effected in the tube by means of a bead of mercury, which moves backwards or forwards as the air within the cistern expands or contracts. Its motion upwards shows the effect due both to an increase of heat and decrease of atmospheric elasticity. By the several adjustments of the tubes and cisterns, an equal increase of temperature raises the alcohol and mercurial bead to equal heights in the respective tubes; and thus, when at any period after such adjustment, the bead shall rise above or fall below the height of the alcohol, such elevation or depression will be caused by a difference in the atmospheric pressure alone, and will become the measure of the same.

Let $\frac{1}{d} =$ internal diameter of air tube,

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and C = contents of air cistern in inches; then $\frac{1}{28500}$ being nearly the dilatations of the inclosed air for a difference in height of one foot in the atmosphere near the surface of the earth, $\frac{d c^3}{28500}$ will be the corresponding linear elevation of the mercurial bead in inches. If we suppose $d = 40$, and $C = 1$, this quantity will be nearly ·056 inches, or about 1-18 inch; a quantity comparatively very great, and capable of being observed with the greatest facility. The importance of a large thermometric scale to the instrument is thus exemplified, since one degree of temperature causes a rise of the mercurial bead equal to that produced by a vertical ascent of 160 feet.

Between the two screws, *st*, placed at the extremities of both cisterns, there is a small stop-cock *a b*, the construction of which is explained by figs. 2 and 3; this, when open, allows the fluids to escape from the main cisterns A B, to the supplementary ones *w w*, according to the adjusting motion of the screws. By such means, the zero height of the mercurial bead and alcohol, may be fixed as well as the exact quantity of fluid in the cisterns necessary to render their linear expansion from temperature equable.

Let R,*q*, represent the quantities in bulk of an acid and alcohol respectively contained in the cisterns (which must be as nearly equal as possible, in order that expansion of the substance of which they are composed, may not affect the one more than the other), B *b*, the internal diameter of the tubes, and E *e*, the effects of heat in altering their volumes; then $\frac{Q B}{E} = \frac{q b}{e}$ when the linear dilatation is the same—let $Q = q$, then $b = \frac{B e}{E}$ in the case of air and alcohol, $E =$ ·002083 and $e =$ 000611 for one degree of Farenheit, therefore, $b = \frac{10}{34}$ B. In actual construction, the discrepancies arising from the ratio of tubes not exactly corresponding to this quantity, is easily compensated by moving the adjusting screws *s t*.

It is, however, by no means necessary that the scale of the alcohol thermometer should correspond with that of the other. They may be separated, and the corresponding degrees marked off on each—it being only necessary to note the necessary deduction at each observation.

The zig-zag direction of the tubes enables a great length to be inclosed in a portable form. A box, 1 foot long, 6 inches broad, and 1 inch deep, is sufficient for enclosing the instrument, when an ascent of 1 foot causes a linear expansion of the inclosed air $= \frac{1}{100}$ of an inch.

I am, Sir, Yours, &c.
N. S. N.

Edinburgh, June 2, 1831.

BURSTING OF STEAM BOILERS.

Sir,—In last Wednesday's *Evening Mail* there is an account of the bursting of a steam-boiler at Liverpool, which, besides other mischief, occasioned the loss of several lives; and, as the following suggestion may possibly lead to further improvements, and be ultimately beneficial, I shall be much obliged to you if you will give it publicity through the medium of your miscellany.

Let engine-makers construct their boilers, in future, with the sides *and ends* convexing inwards, instead of outwards, and, I think, there can be little doubt that a steam-boiler, constructed in this form, would be better calculated to resist *internal* pressure, than one with the sides convexing outwards. But, as facts, when they can be procured, are more to be depended upon than theoretical reasoning, it would be worth while to try an experiment, first of all, with two small metal models, one of which should be a hollow cylinder, and the other have its sides and ends convexing inwards. Let those two vessels be placed under the receiver of an air-pump; and, as the air is drawn off, I *think* it will be found that the cylinder will not only burst first, but will be shivered into fragments; while the other, if it should burst at all, will merely rend at the joinings, so as to let the air, or steam, escape, and would do no further mischief.

Yours, &c. WALTER FORMAN.

Pilton, near Shepton Mallet,
July 15th, 1831.

[We observe, in the *Staffordshire Advertiser* of the 23rd inst. a letter from our ingenious correspondent, Saxula, in which referring to the accident that has called forth the preceding communication from Mr. Forman, he observes, "Had my *surety plate of sheetlead*, described in your paper of the 8th May, 1830, and thence copied into other publications, been affixed to such a boiler, it would have been physically impossible to burst it with steam. About twelve months ago I tried to burst a steam-engine boiler, used for winding up coal, but did not effect it; the surety-plate gradually became thinner as the heat and elasticity increased, swelled into a hemisphere, and then tore asunder, without any fragments, letting off the steam with a loud but harmless explosion. New methods, however good, work themselves but slowly into use; they require *line upon line, precept upon precept.*"

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NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

(Continued from p. 246.)

MANUFACTURE OF PAPER. — *Messrs. Ibotson, of Poyle, near Colnbrook, Bucks.* —All rags abound in knots, and nearly all papers are more or less disfigured by hard protuberances caused by such knots, having passed untouched through the engines by which the rags are reduced to pulp. The universal practice has hitherto been to have every sheet examined separately, that these knots might be picked or scratched out by women with knives, in which process many sheets were unavoidably spoiled and almost all defaced. The present improvement of Messrs. Ibotson consists in extracting these knots from the liquid pulp by straining it. From the circumstance of the pulp being formed into paper by flowing over a fine wire sieve or mould, an opinion has been entertained that straining the pulp through fine apertures is impossible. Instead, however, of a wire sieve or mould, Messrs. Ibotson employ a strainer, consisting of a grating of bars about half an inch wide, and one hundredth part of an inch asunder, with a rim of two or three inches deep. It is placed in the vat, with the underside of the bars just touching the pulp in the vat. The pulp to be strained is then poured into the strainer, and the strainer is lifted up about one quarter of an inch, and let drop with all its weight on blocks placed under it. From 150 to 200 such falls are given to it every minute, and ultimately the pulp is forced quite through the strainer. When this apparatus is applied to a paper machine, it is placed in the usual vat, where it strains the pulp for all sorts of paper, and keeps pace with the regular progress of the machine without interruption. Its application to a vat worked by hand, is stated to be equally easy. *Date of Pat. Aug.* 29, 1830; *of Spec. Dec.* 29, 1830.

CLEANSING RAW OR COARSE SUGAR. — *Andrew Ure, M.D.*—The new means of purification which Dr. Ure proposes to employ, consists of a mixture of alcohol and sulphuric (or any other equally-powerful) acid, in the proportion of one gallon of the former (40 degrees over-proof) to one ounce of the latter. Sugars cleansed by this mixture are stated to be so free from every extraneous matter that they may be packed in bags instead of hogsheads for exportation. *Date of Pat., Oct.* 20, 1830; *of Spec., April* 20, 1831.

COAL WORKING.—*William Wood, of Summer Hill, near Newcastle-on-Tyne.*

—Mr. Wood proposes to detach the coal in much larger blocks than usual, and with much less expenditure of human labour, by the employment of a battering ram to drive in the wedges. The ram is to be placed on a railway, adjustable to any required angle: but at all times so inclined, that the ram may descend by its own weight. It is to be worked by two men, by means of handles projecting from each side. The principle of this engine is similar to that of the pile drivers; the only difference being, that in the former the force of gravity is brought to bear in a slanting direction, and in the latter vertically. It offers a very simple means of abridging, to a great extent, the labours of almost every class of miners; and we hope to see it, ere long, in general use.—*Date of Pat., Dec.* 23, 1830; *of Spec., April* 23, 1831.

SUBSTITUTE FOR GLASS, SAND, EMERY, AND OTHER SCOURING-PAPER, *Richard Edwards, of Dewsbury.*—Mr. Edwards' substitute for paper is calico; but on what ground he has taken out an exclusive privilege for the use of it, we are at a loss to comprehend. Last year, a Mr. Lowthrop obtained from the Society of Arts a premium for the manufacture of an emery-cloth, of which calico was the basis; and in p. 15 of our present volume, the reader will find the process followed in that manufacture fully described.—*Date of Pat., Dec.* 6, 1830; *of Spec., June* 6, 1831.

IMPROVEMENTS IN PREPARING ANIMAL CHARCOAL, *William Parker, Albany-street, Regent's Park.*—Mr. Parker would have stated the substance of his patent more correctly had he described it to be, not for a mode of "preparing animal charcoal," but for a mode of renovating it after it has been once used and deprived of its purifying properties. The charcoal is to be first washed; then passed through a coarse sieve; and, finally, heated in crucibles to a bright red, and kept at that heat as long as any inflammable gas continues to be given forth.—*Date of Pat., Jan.* 15, 1831; *of Spec., May* 14, 1831.

LOCOMOTIVE-MACHINES, *Thos. Bramley and Lieutenant Robert Parker, R. N. Moulsey Priory, Surrey.*—The claim of the patentees is to "certain improvements on locomotive and other carriages, applicable to rail and other roads; which improvements, or part or parts thereof, are also applicable to moving bodies on water and working other machinery." These improvements consist in applying animal power within the body of a carriage to effect its propulsion. Two methods for this purpose are proposed. By the first, the feet of the animal are to be applied to a pair of tread-wheels, the rotary motion of which is to be communicated by a train of wheel-work to the axles of the carriage. By the second, the feet are to be alternately pushed backward, as in the act of swimming, against two boards, which are connected with and impart a continuous action to two cranks, fixed at right angles to each other on the axle of the carriage. The former method is pointed out as more particularly suitable to horses; the latter to men. We do not see, however, in what the novelty of either consists. Many similar, if not identical plans, may be found on the records of the Patent-office. The celebrated Dr. Cartwright exhibited in the streets of London, in 1820, a carriage which he called "The Centaur," from its being worked by men, in a manner similar to the second method of the present patentees. In a letter, which we have of Dr. C.'s, he says, "My Centaur-cart I have much improved in power and velocity; and in a short time I hope it may be denominated a *curricle.*" Notwithstanding all the Doctor's improvements, however, he was never able to overcome the natural obstacles which opposed themselves to every such application of animal power.—*Date of Pat., Nov.* 4, 1830; *of Spec., May* 4, 1831.

(To be continued.)

REMARKS ON THE SCHEME OF A HYDRAULIC MOVER ON THE PRINCIPLE OF BARKER'S MILL.

Sir,—I consider your correspondent, a Journeyman Mechanic, p. 249, has evinced some ingenuity in his invention of what he calls an Hydraulic Mover (query? perpetual motion). As this scheme concerns my hobby-horse, perhaps I may be allowed room for a few observations upon it, which I will render as concise as I can.

From the engraving, illustrating this plan I think we may take for granted the following particulars.

1. That whatever quantity of water may ascend the shorter leg of the syphon, the same quantity will descend through the longer one, and supposing, for argument's sake, the scheme to be efficient, it remains to be enquired what part of it is brought to act on the machinery employed in keeping up the circulation? Now, though it so happens, that my whole library of reference is at present limited to the last monthly part of the Mechanics' Magazine only, yet such is the value of its contents, that I have in it two good authorities to support me in observing, that as the two columns contained in the ascending and descending legs of the syphon are in equilibrium, except that portion by which the longer leg exceeds that of the shorter —it is the weight of this portion only that is to be considered as the moving force acting as a centrifugal one on the arms of the machine.

2. That this difference in the altitude of the two columns is represented by a vertical line drawn between two horizontal ones passing through the centres of the orifices of the longer and shorter legs respectively—which vertical line represents the moving force or power.

3. That a column of water having the same area for its base, and of an altitude represented by a vertical line from the orifice of the shorter leg, to the surface of the water in the well or lower reservoir, will be the weight or resistance to be overcome. (We will leave friction out of the question for the present.)

Granting all this, I admit, that the introduction of Barker's principle secures, with regularity, the maximum force or power of such a column as may be acting upon it, and in the most effective direction — its centrifugal action being perpendicular to the lever or a tangent to the circle moved in. In this consists the superiority of this construction over a common water-wheel, in which, to say nothing of the irregularity of its action, the unavoidable waste of water is a great loss of power. Moreover, the power in this construction always acting as a centrifugal force, may be more familiarly calculated by being* compared to an equal weight, attached to a line, coiled round a wheel or cylinder, and giving motion to it by its descent in a vertical line.

These premises allowed, I proceed to say, that the machinery here contemplated, is actually or virtually nothing more than a connected system of levers, and that an equilibrium of forces is all that could be obtained when those forces are brought to circulate into each other; or, in other words, to become alternately weight and power. Such an equilibrium has been the *ne plus ultra* of all attempts of this kind hitherto made public — and, perhaps, it may be admitted, that were it perfectly effected, there would be nothing (a first impulse being given) but the resistance arising from friction to overcome, to produce continued motion,—the resistance of atmospheric pressure being little, and perhaps, in some cases nothing, to the motion of cylindrical bodies on their axis.

But as mere opinion on subjects of this kind is of little value without demonstration, I will endeavour to trace the operation of the machinery proposed as represented in the engraving.

To give every advantage, I shall consider the plan so far improved (not easily done) that the height of the column to be lifted (or its equivalent weight) does not exceed that contained in the extra length of the longer leg (in the engraving it appears about two to one.)

Let us then suppose the power equal to the weight or resistance, and the length of the arms of the shaft from the centre of the orifices, to be equal to the diameter of a circle whose circumference is 21; let the circumference of the wheel E be 14; that of the wheel E on the spindle, be 3½; and the radius of the crank 1; or as the power of the crank is a variable quantity, and the crank not a balance or lever of equal arms, let it be of such a radius as is equal in its effect to the constant quantity of 1, acting by a tangential force; the integer representing one half the column of water constituting the moving power, and also (with the indulgence given) the resistance to be overcome.

Under these suppositions, the wheel E being centered on the shaft with the arms B B, will perform its revolution in the same time. The same will be the case with the small wheel E, on the spindle and the crank, and the only multiplication of the revolving motion will be by the action of the wheel on the shaft, on that on the spindle to which the crank is affixed, of which it forms a part; which wheels being in the ratio of 14 to 3½, will cause the crank to revolve 4 times during one revolution of the arms or first mover.

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* In making this comparison, I assume that the velocity of the machine will be regulated by that of the jet issuing from the arms of the shaft—if in error, I await the correction of the better informed.

As to the power gained by the leverage, the length of the lever arm B B, being to E as 21 to 14, a power of 2 will sustain a weight or resistance of 3, and the wheel on the shaft acting on the one on the spindle with a power of 3, and the diameter of the wheel and crank being virtually as 3½ to 2, the first moving power of 2, will sustain a pressure on the crank of 5,25 or 5¼.[*]

The next enquiry is what weight must be raised in one revolution of the first mover, or 4 of the last or crank to supply that expended?

As I have assumed that the velocity of the first mover will be that of the set: and may be measured by a line coiled on the periphery of the circle, described by the first mover, the quantity discharged or expended will be represented by 21, the circumference of the circle, which is the exact quantity raised by four revolutions of the crank (all practical difficulties removed, and the machine supposed to be effective); so that a preponderance would still be wanting, and an additional force would be requisite to overcome friction, &c. Were this additional force applied, the circulation would be kept up, but without it the whole system would remain at rest, and the water that might be placed in the upper reservoir would be decanted by the syphon into the well or reservoir below.

Yours, &c. HEZRON.

MINOR CORRESPONDENCE.

Locomotive Engines—J. H. R. of Kirkdale, is informed that the boiler of the William the Fourth is on the same plan as the Novelty—with this difference only, that instead of a blowing apparatus, an exhauster is employed at the end of the furnace, to produce the requisite draught. On the cause of its failure we have nothing to add to what we have already said on the subject, in our 397th number, pp. 39-40. If our correspondant will send us a drawing (no matter how rough) of his projected improvements, we shall give him our opinion of them. In the mean time, we may observe, that there has been already more than one attempt to accomplish the same thing which he has in view.

Mr. Clegg's Gas-Meter.—"A Constant Reader," at Peckham, wishes to know who "is to pay for the gas which must be burnt in order to keep Mr. Clegg's Gas Meter in operation." We should say, the seller and buyer between them, in consideration of the mutual benefit they will derive from its adoption.

Mr. Gurney's Steam-Carriage.—A correspondent at Gloucester observes, in regard to an inquiry by "A Looker-on," respecting the construction of Mr. Gurney's steam-carriage, that "if he will consult the specification of a patent granted to Messrs. Trevithick and Vivian about twenty-nine years ago, and which he will find in the Repertory of Arts for 1802; and also another patent taken out by a Mr. John Moore, of Bristol, about twelve months before Mr. Gurney's appearance in the field;—he will meet there with very full and acrurate descriptions of nearly every thing that Mr. G. claims to have subsequently invented."

Sir George Cayley's Safety Railway-Car.—The learned Baronet, to whom we were indebted for the very valuable paper of Practical Hints on Railway Travelling, published in our 404th Number, observes in another communication which we have since received from him, that "perhaps a better plan for setting the plough to work, (see fig. 1, letter D), when a person is in danger of being run down by a steam-carriage, would be to have six or seven rods, suspended loosely from a frame about six feet high, each of which rods should be so connected with the liberating-catch (E) that on their encountering any such obstacle as a human body, the catch would be set free, and the safety-plough be instantly brought into full play."

Cochrane and Galloway v. *Braithwaite and Ericsson.*—J. G.'s taunts on the subject of this trial are, to say the least, premature. We may, perhaps, be able hereafter to show that they are besides very undeserved. We said, that we expected to have it in our power to lay a full and authentic report of the trial before our readers; and that, when we did so, we should probably go into the question raised by another correspondent, and now re-echoed by J. G., respecting the bearing of Lord Tenterden's opinion on the merits of the rival inventions. This was but a fortnight ago, and there has been surely no such delay as to justify an accusation against us, of an inclination to keep back the truth The short-hand writer's notes of the case are now in our possession; but, how soon we shall be able to spare room for a digest of them, we cannot say—as they are very long and there are several other matters (the opening of the London Bridge in particular), which have a more immediate claim on our attention. It may, perhaps, suffice in the mean while, to silence such carpers as J. G., to quote the words which were actually used by the Lord Chief Justice:—"It appears to me, on looking at the whole of the patent (of the plaintiffs) that it is an essential part of their invention, that the exit of the air which is forced into the flue should be in some way prevented. This they do by means of a valve kept down by a weight, or a column of water. Now, the defendants, instead of having any such valve to regulate the exit of the air by contracting gradually the tube, or flue, or whatever you may call it, till, in the end, the air passes freely through and goes off in the chimney. I THINK THE TWO METHODS ARE ESSENTIALLY DIFFERENT. Therefore, call the plaintiffs."

German Silver.—Sir, The "German Silver," which, though long since known to the manufacturers of Birmingham, has but recently obtained the notice of the public, is stated to be composed of copper, nickel, and zinc. But I have seen no specification of the requisite proportions of each. It has been stated to be "*entirely unalterable*," so as to be equal, if not superior to gold or silver for the touch-holes of guns. If so, I should suppose its employment for the pivot holes of clocks and watches would add to the durability of those machines. If this alloy is not corroded by the pungent fumes of the sulphur contained in the gunpowder, it is natural to conclude that it would be perfectly insusceptible of injury from the *very* slight acidity that may exist in the oil used by watchmakers. If any of the readers of your miscellany will be so kind as to specify the proportions of the above metals in this alloy—or to say where German silver wire of 1-10th of an inch in diameter may be obtained—it will gratify many of your readers attached to the study or practice of horology; and none more than, Sir, your humble servant, AN EXPERIMENTALIST, *London*, *June* 23.

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[*] *i. e.* at its medium point of action.

[The following are the proportions in which the three metals should be combined, according to a statement in the *Bull. d'Encour*. for July, 1826:—Copper, 53·39; zinc, 29·13; nickel, 17·48.—ED. M. M.]

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MISCELLANEOUS.

Improved Mangle.—We quote the following notice from the *Lancaster Herald* of the 23rd inst. and hope to be soon favoured by our friend, Mr. Saul, with a drawing and description of the machine to which it refers:—"*A Reform Mangle.*—Several experiments, which have excited considerable interest among persons conversant with mechanical power, have been made during the last week relative to the above machine. We are informed, that Mr. Matthias Saul, of this town, was requested about a year ago to endeavour to reduce the expense and labour attending its use, so that it might be introduced into most families, but especially into farm-houses. By this machine, the linen may be both *ironed* and *mangled* at the same time. The mangle is worked by a moving-table, which passes under a pressure of one and a half ton. The operation may be performed by a child of eight or nine years old. The machine does not occupy a space of more than eight superficial feet, and the weight of the whole is not more than two cwt."

Easy Method of taking off the Bottoms of Bottles.—Mr. J. Marsh states, that he has occasionally employed with success the following method of taking off the bottoms of phials, &c.:—"I pour a small quantity of sand or emery into the angular turned-up part of the vessel, with a few drops of water to moisten it; then by means of a piece of wood having a sharp point, I press the moistened sand, &c., into contact with the glass, and by gently turning the bottle round, bringing the point of the wood and the sand into contact with every part of the lower end of the phial in succession. By these means the surface is quickly scratched, and immediately after a fracture takes place all round the bottle, which instantly separates the bottom. This effect does not take place with all sorts of bottles, but in very many it does."

Endless-Power Machine.—An engineer of Bristol, named Richards, has, after fifteen years study and labour, completed a machine which he calls his "Endless-Power Machine," *which is now in motion.* This engine, it is said, will supersede the use of steam in all its various purposes. The inventor declares, that his self-acting engine of 250 horse power will take a vessel round the world with the small quantity of two gallons of oil applied to its movements when required.—*Bath Herald.*

La belle France!—M. Flaugergues, of Viviers, who has kept for forty-seven years a register of the quantity of rain which has fallen in the south of France, states, that calculating by periods of tens of years, the quantity of rain, and the number of rainy and cloudy days, is continually on the increase.

Lot's Wife.—Professor Daubeny, in his work on volcanoes, supposes that volcanic agency was the physical instrument employed by the Almighty to destroy the five cities of the plain; that the Salt, or Dead Sea, arose either from the subsidence of the plain, or from the damming of the Jordan by a current of lava; that the showers of fire and brimstone were occasioned by the fall of volcanic ejections; and (agreeing in this with Mr. Henderson, the celebrated missionary traveller in Iceland), that Lot's wife, lingering behind her friends, may have been first suffocated, and then incrusted with saline and other volcanic materials.

Vinegar an Antidote to the Effects of Opium.—The Persians, and others who make use of opium to excess, frequently swallow draughts of vinegar immediately after opium. Dr. Crump observes, that when a patient finds himself in a distressed situation, he has recourse to a piece of opium as big as his thumb, and immediately after drinks a glass of vinegar. This throws him into a fit of laughter and every extravagance of mirth; and frequently terminates in death.

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INTERIM NOTICES.

We did not think it proper to publish on anonymous authority the statements of J. B. respecting the performances of a certain engine near Regent-square, until we had made personal inquiry into their correctness. We have now done so, and shall report the result in our next.

P. H.'s plan for facilitating the taking up of passengers on railways, is ingenious; but the objections to its practical adoption are so many, and some of them so insuperable, that we see no good purpose that would be served by its publication.

Communications received from Mr. Hartwell—Δ—Mr. J. Ashurst, Jun.—A Constant Reader (at Braunstone)—G. G.—A Seeker after Knowledge—Twankay—B. J. A.—T.—C. T.

Errata, communicated by R. V. K.—P. 176, in the title of the paper on the smoke-jack, for "p. 128," read "p. 127."

P. 187, col. 1, the sentence beginning at line 12 from the bottom, should read thus:—"For instance, at the bottom of the receiver of an air-pump place a vessel of water, into which put the end of the suction-pipe of a small common pump; make all tight, exhaust the receiver, and at the same time you will necessarily form a vacuum in the pipe below the pump-clack, or bottom-sucker," &c. The reader will readily perceive, that exhausting the receiver and pipe are but one and the same process, and cannot be carried on separately while the communication is open as described.

——— col. 2, line 9, insert the word "and" after "rush in."

——————— 10, dele the comma after "quantity."

——————— 4 from bottom, insert "ft." after 32.

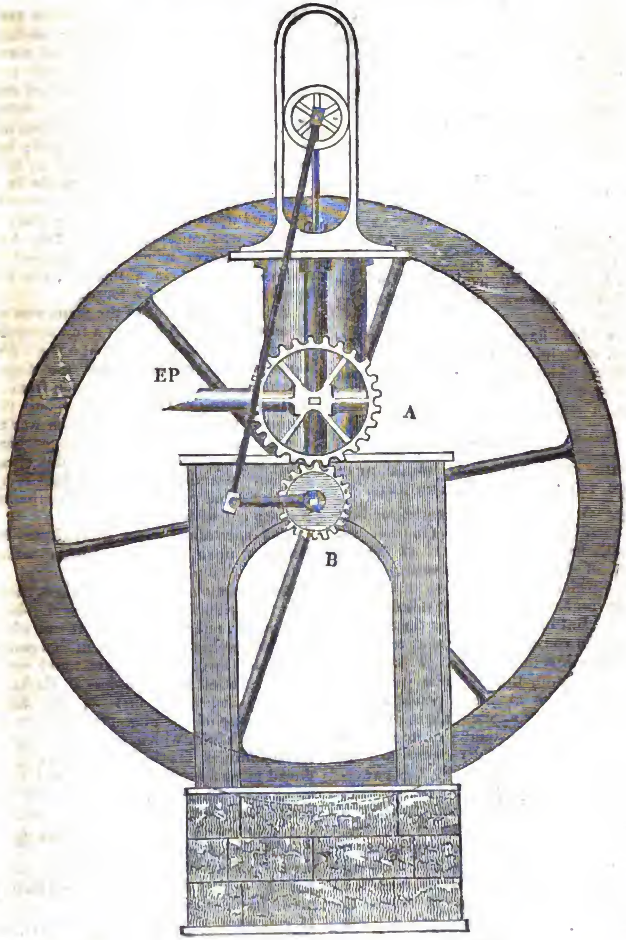
LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office-court, Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 417.] SATURDAY, AUGUST 6, 1831. [Price 3d.

IMPROVED HIGH-PRESSURE ENGINE.



MODE OF OBTAINING A REGULAR ROTARY MOTION FROM THE TWO-WAY COCK OF A STEAM-ENGINE.

Sir,—I hand you a sketch of a working model of a high-pressure engine, in which, by the application of a wheel and pinion, rotary motion is communicated to the two-way cock, whereby the objection to its application to the steam-engine, on account of partial and irregular wear, is obviated. The model is about one-third of the size of the engraving, and though not constructed in due proportion, exceeds my expectation, and works with rapidity and precision.

Yours, &c. J. ELLIOTT.

March 5, 1831.

Explanation of the Engraving (on the preceding page).

S P, steam-pipe.

E P, eduction pipe.

A, a wheel of 30 teeth, fixed on the head of the two-way cock, and revolving with it.

B, a wheel fixed on the axis of the fly-wheel, containing 15 teeth, half a revolution of which turns the wheel A, and two-way cock, one quarter round, thereby giving a regular rotary motion.

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ON THE APPLICATION OF SOLAR HEAT TO THE PURPOSES OF THE ARTS.

Sir,—A very intelligent correspondent of yours, Mr. G. Dakin, (in vol. xv. p. 318), expresses his regret at the removal of Perkins' magnificent lens to China, which, as a specimen of art and British ingenuity, certainly stands unrivalled. But in what manner the arts are to suffer in consequence of that removal, I am at a loss to conceive. I have not the least doubt, that if there were any specific purpose to which such a lens could be usefully applied, there are men to be found in this country quite competent to produce one fully equal to Parker's; considering especially the powerful aid which they can now derive from machinery. There are many things curious, very curious, but which we are, nevertheless, compelled to admit are of very questionable public utility. Among the number I am disposed to rank the lens alluded to, which, it seems to me, is likely to be of quite as much use in China as it would be in the exhibition-room of the Royal Institution, or any where else.

The effects produced by this burning-lens were certainly very remarkable; and perhaps a brief recapitulation of them may not be here out of place:—

1st. Every kind of wood took fire in an instant, whether hard or green, or soaked in water. 2nd. Thin iron-plates grew hot in a moment, and then melted. 3rd. Tiles, slates, and all kinds of earth, were almost instantly converted into glass. 4th. Sulphur, pitch, and all resinous bodies, melted under water. 5th. Fire-wood, exposed to the focus under water did not seem changed; but when broken, the inside was burnt to a coal. 6th. If a cavity were made in a piece of charcoal, and the substances to be acted upon were put in it, the effect of the lens was much increased. 7th. Any metal whatever when thus inclosed in charcoal melted in a moment, the fire sparkling like that of a forge.

Although the heat of the focus was so intense as to melt gold in a few seconds, yet there was so little heat at a short distance from the focus, that the finger might be placed about an inch from it without injury. The proprietor had the curiosity to try what the sensation was at the focus, and having put his finger there for that purpose, he described the effect not as resembling that produced by fire or lighted candle, but as like that of a sharp cut with a lancet.

The substances most difficult to be wrought upon were those of a white colour.

As we are on the subject of glass, there are two circumstances which I shall mention in reference to the present state of the manufacture of glass in this country, which are, in my opinion, much more to be regretted than the loss of Parker's burning-lens. The first is, the total breaking up of the glass-manufactory at East Smithfield, which, to say nothing of its reputation for looking-glasses, produced glass for optical purposes which no other establishment in England has yet been able to equal in purity; and which was allowed to be superior to any ever manufactured on the Continent. The second circumstance to which I allude is the bad quality of the flint-glass which is made for the object-glasses of telescopes. If you want a piece of good glass, you must apply to the French, who have latterly acquired the pre-eminence in this branch of art. I know we live in a day in which quantity, and not quality, is the chief consideration, in order that we may be enabled (as the commercial phrase is) to compete with foreign markets. But surely quality is worth some consideration, if we wish to maintain our ancient commercial ascendancy among the nations of the world.

I think some of the mirrors mentioned by your correspondent would produce an excellent glare of light for a light-house; but they appear to me quite inapplicable to the purposes he has in view. I look upon it as quite certain, that regularity of surface is indispensably requisite to concentrate the rays of the sun on one point.

With respect to the speculum-metal, it is not my intention to enter into the chemical theory of its composition; I have gleaned, however, from experience one or two lessons on the subject, which are much at the service of your readers. I have tried a mixture of 14½ oz. grain tin and 2lbs. of cuttings of plated metal; and to each pound of this mixture I have added 1 oz. of metallic arsenic. If your correspondent, Mr. Dakin, will do the same—if he will melt 10 or 12lbs. of this metal in a crucible—he will find obstacles to contend with very different from those to be met with in a tobacco-pipe. I once took a quantity of this metal to Mr. J. Braithwaite, Engineer, to have it cast into plates 7 inches by 5, and though he personally superintended the process, he assured me, he experienced the greatest difficulty in casting them, for, on exposure to the air, they broke like hot glass placed in cold water. This was afterwards prevented by taking them out of the mould, and subjecting them to a red heat, and letting the fire go out and the metal cool together. No person ought, however, to engage in this metallic speculum-work who is not fortified with more than an ordinary degree of patience, as it constitutes with respect to the working part a prime requisite. I think a pitch-polisher superior to silk, and water preferable to oil or pomatum for polishing.—Yours, &c.

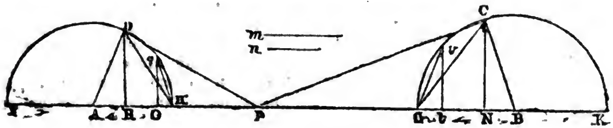
J. SMITH.

17, *Bath-place, New-road.*

SOLUTION OF MATHEMATICAL PROBLEM, NO. 3, VOL. 15, P. 62.

PROBLEM.—*Given two circles, A and B (see diagram); required to find a point P in the line joining their centre, from which two tangents PC, PD, being drawn, draw the chords CG, DH, so that CG:DH in any given ratio, as m to n.*

Solution by an Oxford Student.



Let P represent the required point in the line joining the centres of the two circles, and draw the lines as in the figure. From the extremities of the diameters, G and H, inflect two chords GV, HS, equal to *m* and *n*, or in the ratio of *m* to *n*, and draw the perpendiculars V *t*, S O.

Assume GK $= 2a$, HF $= 2d$, PQ $= x$, GN $= y$, HG $= r$, G $t = c$, HO $= e$ $\therefore$ PK $= x + 2a$; and by the circle PK·PG $=$PC², or PC² $= \overline{x + 2a} \cdot x$, also PC² $=$ PB · PN $= a + x \cdot \overline{x + y} = \overline{x + 2a} \cdot x$, from which $y = \dfrac{ax}{a + x}$; again, GC² $=$ GK · GN $= 2ay = \dfrac{2a^2x}{a+x}$. In the same way, by supposing PH $= z$, we find DH² $= \dfrac{2d^2 z}{d+z}$, but $x + z = r$ $\therefore$ $z = r - x$ $\therefore$ DH² $= \dfrac{2d^2 \cdot \overline{r-x}}{d + r - x}$. Again, since GC² : DH² :: $m^2 : n^2$: GV² : HS² :: GK·G t : HF · HO $\therefore$ $\dfrac{2a^2 x}{a+x} : \dfrac{2d^2 \cdot \overline{r-x}}{d+r-x} : 2ac : 2de$

or $\frac{ax}{a+x} : \frac{d(r-x)}{d+r-x} :: c : e$, or $\frac{ax}{a+x} : \frac{d(r-x)}{S-x} : c : e$ (assuming $d+r = S$) multiplying extremes and means, and clearing of fractions, &c. we obtain $x^2 + \frac{(sae+adc-dcr)}{dc-ae} x = \frac{adcr}{dc-ae}$.

Solving this quadratic, the value of x, and consequently the position of the point P becomes known.

A geometrical solution for the problem may be obtained as follows:—Since $\frac{ax}{a+x} : \frac{d(r-x)}{d+r-x} : c : e \therefore x\ (d+r-x) : (r-x) \cdot (a+x) : dc : ae$, that is, AP·PG : PB · PH : AH · G t : GB · HO.* But AH, G t, GB, HO, are all given ∴ the ratio AH·G t : GB·HO is given ∴ the ratio AP · PG : PB · PH is also given. The construction is, therefore, reduced to the same as the 16th problem of the 2nd book of Professor Leslie's Geometrical Analysis.†

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BURSTING OF WATER-PIPES AFTER FROST.

(Selections from Correspondence, continued from last Number, p. 341.)

Sir,—I beg leave to send you a reply to the question concerning the bursting of water-pipes by frost. Though I am no adept in natural philosophy, yet I have had frequent occasion to observe the effects of congelation. Some time past I had the superintendence of a very extensive property, where there was a number of large marble vases always filled with water for some particular purposes. In winter these vases required great care, lest they should be destroyed by frost; and I always observed, as you have, Mr. Editor, justly pointed out at p. 259, that water contracts till it comes to the freezing point; and at about 32° it dilates with such force, that I am not at all surprised at the result of the calculations made by the Florentine Academicians, however extraordinary it may seem. I was obliged to have the ice broken as it was formed. This led me to examine the effects produced by frost in water-pipes; and I have always seen, that if they do not burst during the congelation of the water in them, they never do so when the ice melts. Very often, after a thorough inspection of a leaden pipe filled with frozen water, finding it to be sound in all parts, I have caused straw to be twisted round it and warm water to be poured thereon; but I do not recollect ever experiencing any disruption, though this kind of melting was much more abrupt than the natural one, and more liable to occasion a disruption in the pipe. I think that generally it is supposed that the bursting of the pipes takes place when it thaws, because it is then that it is perceived; yet it is obvious, that as long as the water remains in a state of congelation we have no reason to suppose a disruption; but as soon as the ice begins to turn deliquescent, the crevice, if any, becomes manifest. Besides, at the same time that the bulk of the ice expands, the bore of the pipe diminishes by the contraction of the sides occasioned by cold, and, of course, contributes to their disruption. I have also observed sometimes trunks of trees split by the congelation of water inside of them; but I never noticed any thing of the kind produced by thawing.

It appears to me, that in this case the difficulty is to explain *how it is* that water *freezes?*

Yours, &c. A. Z.

London, June 27, 1831.

Sir,—As you invite opinions on this subject, I offer to you my solution of the question.

It is perfectly clear, for the reasons you have given, that "An Attentive Reader" was not acquainted with the phenomena attending the freezing of water. A. C. F. appears to me only so far right, that he describes the injury to be done by expansion during the freezing; but that expansion cannot be "*of the air*," as he assumes, for air only expands with *heat.*

I would explain the cause in this way:—Water in freezing is increased in bulk; it expands in every direction, laterally as well as longitudinally, and forthwith exerts the pressure arising from expansion upon every part of the pipe in which it is contained. The circumstance of the pipe being open at one end, is of no avail to relieve it from the pressure, because when the temperature is sufficiently reduced, the solid is formed at once and fluidity is lost. It is true, the expansion begins at 40°; and if this were not the case, if some expansion did not commence before the actual formation of the solid, it is probable much stronger pipes than are used would be required. Still the expansion is going on at the time the solid is formed. The lead, too, is a good conductor of heat; and we may hence suppose, that when the process of freezing is once begun it is very rapid. Hence a mechanical pressure is exerted on the lead; and this pressure may be greater than the pipe can bear in those parts where there is an imperfect joint, or some flaw in the metal. Then comes a thaw, the ice again becomes fluid, and forthwith shows where the pipe has yielded to the force exerted by the ice.

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* This step might have been easily deduced by a geometrical instead of an algebraical analysis.

† I here allude to the 2nd edition.

I do not think Dr. Pearce sufficiently explicit. You treat his communication as if he imagined the ice in melting exerted a force on the pipe. The Doctor can scarcely mean this, because the very absorption of heat would annihilate the repulsion of the particles of water when in the state of ice. Does he mean that the pipe is burst in consequence of the augmentation of temperature in the lead, and of its consequent expansion? If so, I would humbly suggest that the difference of temperature as regards the lead is not so great as the Doctor's letter would lead his reader to suppose; for, though the ice would absorb 140° of heat in becoming fluid, this quantity of heat would only pass *through the lead*, which in itself does not absorb latent heat; its change of temperature would be only from 32° to 50° or 60°. I think I may well question whether so small a change of temperature would act in a sensible degree upon this tenacious metal, especially in so thin a body as a water-pipe; and I will not occupy your pages by pursuing so hopeless a point.

Finally, did Dr. Pearce, or any body else, ever hear of an *empty* lead-pipe being injured by frost? Has any body, for instance, ever observed that a straight pipe, open at both ends, such as those which conduct the water from roofs, was affected?

Yours, &c. P. T.

June 27, 1830.

Sir,—In answer to the question on this subject, I most unequivocally deny that the pipes do burst in thawing; but, on the contrary, in the freezing; and the reason it is attributed to the thaw is, because the leakage does not take place until that time. I am aware this is mere assertion; therefore, I shall proceed to state my grounds and reasons for the same. In order to arrive at a correct conclusion, we must be careful not to take any thing on trust or supposition, but be guided by facts alone. In the first place, I shall state several facts which have been proved and assented to by the most eminent chemists:—

1. That water absorbs air from the atmosphere.

2. That water in freezing liberates a quantity of this air, which may be seen as air-bubbles in the ice.

3. That water after this air has been expelled by boiling, will not produce those bubbles on being frozen.

4. That air occupies a much larger space than water.

5. That water in passing from the liquid to the solid state, first becomes solid at the outside, and gradually to the centre.

6. That water in passing from the solid to the liquid state, first becomes liquid at the outside, and gradually to the centre.

7. That water in passing from the solid to the liquid state, does not increase in temperature until the whole of the ice is dissolved.

8. That water expands, whether the temperature be above or below 42½ degrees, that being its maximum of density.

9. That water in freezing bursts open vessels, as jugs, glasses, &c.

10. That saline solutions expand in cooling, and crystallization takes place; the freezing of water being a species of crystallization.

11. That lead contracts or expands as its temperature is increased or diminished.

12. That all substances in different states of temperature give out or imbibe caloric from each other until an equal temperature is restored.

Now, Sir, having stated these preliminary facts, I shall proceed to examine, step by step, the process of water in passing from the solid to the liquid state, and *vice versa*.

I will assume it as a fact, that a leaden pipe has been frozen 10 degrees below the freezing point without fracture. The pipe being so frozen, and a thaw having commenced by a change in the temperature of the atmosphere, which change is first communicated to the pipe, and then from the pipe to the inclosed ice, we see, by Fact 11, that lead expands by increase of temperature, and consequently hat the pipe will have a tendency to enlarge, and therefore become less liable to fracture. The ice liquefying first in that part in immediate contact with the pipe, and gradually to the centre (Fact 6)—the water not increasing in temperature beyond 32 degrees until the whole of the ice is dissolved (Fact 7)—the water decreasing in bulk until it reaches the temperature of 42½ degrees (Fact 8), which is 10 degrees beyond the liquifying point—the water must necessarily flow away before any expansion can take place. It must be obvious, that no fracture can take place under such circumstances; and, therefore, the pipe is not burst by the thaw.

Now for the real cause of fracture:—Suppose the temperature of the atmosphere to be 42½ degrees, that being the maximum of density of water (Fact 9); and that the temperature gradually decreases until it reaches 10 degrees below the freezing point—the atmosphere will, as it decreases in temperature, imbibe caloric from the pipe, and the pipe again will imbibe caloric from that part of the water in immediate contact, and so to the centre, until the whole is of an equal temperature. The pipe by decrease of temperature contracts, as seen by Fact 11. The water, by decrease of temperature from 42½ degrees, expands (Fact 8). This alone is sufficient to account for the bursting of pipes, namely, the double action of the contraction of the pipe, and the expansion of the water at one and the same time.

But there are other circumstances to be taken into consideration to increase this effect. The water in the pipe begins to congeal at the sides of the pipe, and gradually to the centre (Fact 5); and as water generally contains air, which is separated as the water freezes, and that air has no means of escape in consequence of the freezing first taking place at the surfaces, and as air occupies a much larger space than water (Facts 1, 2, 4), it must necessarily increase the expansive force.

The last reason I shall adduce in support of my position is drawn from Fact 10—that saline solutions expand in crystallization, and that water acts in a similar manner. Facts 11 and 8 are, as I have said, sufficient to account for the bursting; but joined with the two last named causes, I think the conclusion must be satisfactory to the most sceptical.

Yours, &c.

PROFESSOR OF USEFUL KNOWLEDGE.

Finsbury University, 55, Crown-street,
July 4, 1831.

(The conclusion of the subject in our next.)

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NEWTON'S APPENDIX TO EUCLID'S ELEMENTS.

Sir,—I find that Mr. William Pearce, who first introduced himself to the notice of the readers and contributors of your excellent Magazine, as a humble petitioner for geometrical information, (342) has now assumed a more dignified character, namely, that of a mathematical *critic*. He finds fault with me (409) for not giving a demonstration of my construction of the 1st of the three propositions, proposed by him from Mr. Newton's Appendix to Euclid's Elements: or, in other words, not proving that the quadrilateral A K L M (399) *is a square from principles and propositions contained in the* 1st *Book of Euclid, without extending farther than the 23rd Prop.* Mr. P. has surely read of the 46 of Book I., which is a simpler proposition than that of Mr. Newton's. Now, Euclid himself has been obliged in his demonstration of it, to have recourse to the properties of parallel lines; and yet Mr. P. finds fault with me because I cannot accomplish that *which Euclid himself could not effect.* Neither has it been done effectually (as far as I know) by any geometer from the days of Euclid to the present time. True it is, that some of our great modern geometers, among whom may be mentioned, Legendre, Playfair, and Ivory, have ingeniously demonstrated the 32d of the 1st Book of Euclid, independently of the properties of parallel lines. But then it must be remembered, that in doing so, all of these distinguished mathematicians have been obliged to have recourse to *definitions and principles not contained in the Elements of Euclid.* It may, therefore, be safely asserted, that if Mr. Newton intended that both the construction and demonstration should be made out from principles and propositions not extending beyond the 23d Prop. of the 1st Book, he must have expected the student to do that which no one has ever yet done.

Mr. Samuel Simple has pointed out a most glaring inaccuracy (395 and 415) in the way in which the 6 Prop. of the Appendix is placed, and taking advantage of this blunder of Mr. Newton's, he (Mr. S. S.) by supposing the proposition can be proved within the required limits, has easily and truly demonstrated (415) the truth of the 32nd Prop. without going beyond the 13th Prop. of the 1st Book; consequently the demonstration of the required problem follows, as a matter of course. Mr. Pearce not having objected to the way in which the 6th proposition is placed, it might, perhaps, be presumed that he has been able to demonstrate it within the required limits. If such be the case, I trust he will not withold the demonstration from the readers of the Mechanics' Magazine.

Σ's geometrical construction is in appearance simpler than mine; still I prefer my own, for the three following reasons: — 1st. The 23d proposition was contemplated by Mr. Newton, in the solution, and evidently for the construction, as it could be of no use in the demonstration. I therefore thought, I should at least comply with the required conditions of the construction, if I could not with those of the demonstrations. 2nd. The given proposition is only a particular case of a more general problem, namely, "given each of the angles at the base, and the difference of the sides, to construct the plane triangle." Σ's construction will not apply to the above problem. 3rd. I found the construction I have given, may be successfully applied in the solutions of many other problems. I was perfectly aware of the construction Σ has given before I saw his. The key to it may be expressed by the equation $x = \sqrt{2d^2} + d$, where x is the side of the required square, and d the given difference, the construction of which only requires the 11th of the 1st Book of Euclid. Mr. S. Simple says, his construction is simpler than either. I confess it is more general than that of Σ's, because it will apply, although the angle A B D (415) is not a right angle.

Σ gives us (p. 411) a solution (if a solution it can be called) of the 2nd problem from Mr. Newton's Appendix. But it is strange, that this gentleman who writes with as much ease and confidence as if he were the first professor of mathematics in the first university in Britain, should not have first discovered that there are no less than two apparent inaccuracies in the enunciation of the problem. At one part of his construction (the demonstration he has wisely withheld) a small ray of light seems to break in upon him, or, to borrow a masonic phrase, one of his eyes seems to open a little, but the other throughout remains firmly shut; the meaning of which, I believe, in plain English, is, that he has not advanced farther in the mystic science than a journeyman. His solution of the 3rd problem is any thing but a good one; in fact, it is neither one thing nor another.

But, Mr. Editor, I am fearful I have extended this communication to too great a length; I shall only add, that I would advise Σ to re-examine and re-consider his two last solutions. If, however, Mr. Pearce is satisfied with them, then all is well.

Yours, &c.

KINCLAVEN.

PERPETUAL MOTION BY MAGNETISM.

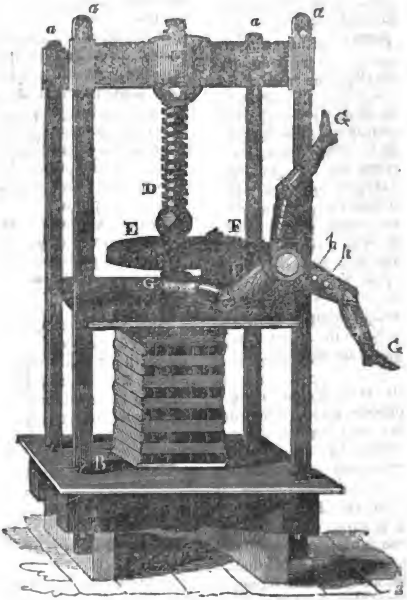
Sir,—I see by the recent volumes of the Mechanics' Magazine, that the perpetual motion seekers are not yet become extinct; they are in mechanics, what the alchemists were in chemistry—they will never obtain their object, though they may make many improvements in machinery. Can any of them make a machine that will turn round as many times as the following simple wheel would?

Turn up and polish a steel wheel; then

procure a magnet of a power just sufficient to suspend it in a vacuum. Fix the magnet in a receiver, and exhaust the air out of it by means of the air-pump, then give motion to the wheel by a powerful spring. Now, here is friction and gravitation nearly annihilated by magnetism, and the resistance of the air reduced to nothing by means of a vacuum; and yet it must share the fate of all mechanical inventions—*it must stop.* If ever a perpetual motion is realized, it must be produced by a physical impulse, such as De Luc's electric column, &c.; and even then, in what would it differ from a tide or water-wheel?

Yours, &c. G. Dakin.

ATHOL PRESS.



Sir,—The above is an accurate representation of Hopkinson's Athol, or standing screw press, which is said to be equal to the *hydraulic*, at two thirds of the expense. This, however, I do not admit; although it certainly makes a much nearer approach to that powerful machine, than a screw-press of any other kind.

The chief peculiarity of this press, consists in the manner in which the rotation of the screw is accomplished, which is effected by means of another screw, as will be understood by the following description.

In the above engraving, *a a a a* are the four pillars or standards of the press. B, the bed-plate. C, the head-piece, with the nut or female screw. D, the main-screw which is iron, and of considerable strength. E, is a toothed wheel, fixed on the axis of the screw, and turning with it. F, is a strong worm, or perpetual screw, of gun metal, working in gudgeons on the moveable board of the press, and taking into the teeth of the wheel E. G G G are three cast-iron levers of an ornamental description,* by means of which, motion is communicated to the endless screw F. *h h* are holes in one of these levers, in which a small metal handle is inserted, when the press is to be unscrewed, or the moveable board of the press to be raised for filling.

The arrangements by which, in this case, great power is obtained, are exceedingly ingenious and effective; the main screw is first equipped with a spur wheel, which being of greater diameter than the screw, gives the first advantage in point of leverage; this is multiplied to a very great extent, by the application of an endless screw to turn this wheel; the endless screw itself, being turned by the power of a man, applied at the extremity of a long lever. So that it will be at once perceived, by those persons who are acquainted with the laws of mechanics, that the power resulting from this judicous combination, is immense.

I have frequently seen a *lad* screw down one of these presses, giving a much greater pressure to its contents, than could have been given by three men with a standing screw-press of the ordinary description.

The spur-wheel on the axis of the screw, driven by a pinion, I am well aware has been in use for a great length of time; but the power gained in that way, bears no comparison to that which is obtained by the combination above described.

One very great advantage attending the Athol Press is the rapidity of its action. In common screw-presses, the workman has to insert a lever in the eye of the screw—make about one-third of a revolution—withdraw, and again insert his lever, and so on; withdrawing and replacing the lever about three times for every revolution that is made by the screw; or, if a wheel and pinion is used, much oftener. In the Athol Press, on the contrary, the lever is fixed, and the workman has nothing more to do than to pull it round as fast as he can; and this, until the pressure becomes great, may be done by means of the small handle at *h*, when the three great levers assume the character of a fly, and a very rapid motion may be given to the endless screw. In the same way, the press may be unscrewed with astonishing rapidity.

Although the assertion may appear rather paradoxical, yet it is nevertheless a fact, that in using the Athol, as compared with any other screw-press, *both time and power are gained.*

The perpendicular manner in which the animal power is applied to work this press, is another point in which it has a most decided superiority over those of other constructions.

Yours, &c. W. Baddeley.

July 12, 1831.

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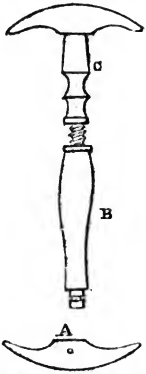
HAT-STICKS.



Sir,—The hat-stick I have now had in use many years must, I think, in most instances take precedence of Mr. Baddeley's improved one (p. 157), first, as regards simplicity, it having no separate centre-piece; and, second, as regards saving of expense, as any person may alter their present one by merely taking off one end, cutting a groove round the stump or tenon, then putting it together with a peg through, so as to work in that groove, when it will possess all the advantages of the new one. A, in the prefixed sketch, represents the end taken off, showing the hole for the peg. B requires no alteration, save the insertion of the groove near the end, as shown. C requires no alteration whatever.

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* After the fashion of the arms of the Isle of Man, of which the Dukes of Athol were once sovereigns, whence apparently the name of the press.—Ed. M. M.

Yours, &c. TREBOR VALENTINE.

SUGGESTION FOR PREVENTING ACCIDENTS BY STEAMERS. BY CAPTAIN BASIL HALL, R.N., F.R.S.

(From the United Service Journal for August.)

In America, in all the steam-boats, the helmsman, instead of being placed abaft, close to the taffrail, in a low situation, from which he can see nothing, is raised on a high platform, within a few feet of the bows, from whence he commands a view, not only a-head and on both sides, but he can see the smallest boats, even when close to the vessel's cutwater.

The advantages of having the steersman in the situation described, are very considerable. In the first place, as I have already observed, he has a complete view of all objects in front of him, and this view cannot be intercepted by the passengers coming in his way. In the next place, it enables him to steer with much greater precision amongst the boats, ships, or buoys, which happen to lie in his course; and it is infinitely easier for him to avoid running over little boats, when he himself can distinctly see what those boats are about. As things are at present arranged, the captain, placed on the paddle-box, or on the bowsprit, calls out to the helmsman to alter the course, and the word has to be passed along from mouth to mouth in a most inconvenient manner.

In America, the captain or the pilot stands alongside the wheel, which is raised, as I have mentioned, on a platform, at the height of ten or twelve feet above the deck, and far forwards. He there gives his directions quietly and distinctly to the helmsman at his elbow; or, if need be, he takes hold of the wheel himself. In any event, the wretched bawling and uproar which at present exist in our boats would be saved, and the passengers would be spared the eternal injunctions to keep out of the helmsman's way.

It may be added too, that under the circumstances above described, of steering in the bow instead of abaft, the rate of moving of the steam-boat may be greatly accelerated with perfect safety, and the reason is obvious. When the person who is guiding the movements of the boat sees his way distinctly, he can venture to run much faster than he now does, when he is virtually blindfolded.

At night, the advantages of steering a steam-boat in the bows are still more important. On the Mississipi it would be impossible, were the steam-boats not so fitted, to navigate amongst the floatings, and the fixed snags, as the trees are called which lie with their roots in the mud, and their sharp tops pointed down the stream. But by having the pilot (who I may mention, always actually, with his own hands, steers the vessel in America) in the bow, and well raised on a platform, all these obstacles can be avoided, even in very dark nights. I need not point out to you how eminently useful the same simple device would be in navigating the river Thames at night, or in foggy, rainy, or blowing weather.

I call the device a simple one, because it absolutely requires no change of principle, and is capable of being adopted in every boat at the expense of half-an-hour's work for a couple of seamen, and half a day's work for two or three carpenters.

All that is requisite is, to have a small platform or scaffold, eight feet square, raised about ten feet or twelve feet above the deck, at the distance of ten or twelve feet from the stem. On this let the wheel be placed, and let the tiller ropes, after passing round the barrel, be led through blocks in the deck beneath, and again through blocks or sheeve holes on the bulwark, low down. The ropes then stretch along outside, and are supported on fair leaders or rollers till they reach blocks above the counter, and being rove through these, they are made fast to the end of the tiller, which it is best to ship abaft the rudder, so as to keep the poop or quarter-deck quite clear for the passengers, and to prevent the possibility of any thing coming in the way of the tiller.

It is well to have those parts of the tiller ropes which cross the fore part of the deck, enclosed in what is called a trunk, or wooden pipe, to prevent injury from the feet of persons passing to and fro, or interruption from things lying about the decks.

It might at first be supposed, that the great additional length of the tiller ropes, and the distance of the wheel from the rudder, might make it difficult to steer the vessel. Such, however, is not the fact, as I can testify, from having myself steered many steam-boats in America, of from three to four hundred tons burthen, and with perfect ease.

Practically speaking, therefore, there is no objection to the adoption of this method of steering our river steam-boats, and the expense must be quite immaterial; and I venture to prophesy, that the instant the plan is adopted by any one vessel, the advantages will be found so great, it will be generally adopted by them all.

For sea-going steam-boats, this method of steering is not so necessary, nor would it be quite so easy of adoption. But all steam-boats which perform part of their voyage at sea and part on rivers, such as the Edinburgh and Leith vessels, might very readily be fitted with two wheels and two sets of tiller ropes: one abaft, as at present, to be used at sea; the other elevated on a platform to be brought into play on entering the river.

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SUNDAY SCHOOL JUBILEE.

Every period of time which marks an era in the civilization of mankind is worthy of commemoration; its approach will not be unheeded by those who mark the signs of the times, and are ever ready to hail with joy the arising of any true star, which shall tend to spread the light of truth—that light which is destined, sooner or later, to dispel those mists of error, prejudice, and ignorance, which becloud the mind of man, and lead him so often astray in paths that conduct to sorrow and destruction. Among the many efforts which have been made by benevolent men to promote the improvement of their fellow-creatures, none have been attended with more distinguished success, or have had for their end more unmixed benefit, than the establishment of Sunday Schools; a class of institutions which, as the reader is doubtless aware, owe their origin to the pious benevolence of that great and good man, Robert Raikes, of Gloucester. To enter into a history of these admirable nurseries for youth is not our object at present; suffice it to observe, that to contemplate such magnificent effects produced through the spontaneous endeavours of one man, must be a task as delightful as instructive to every true friend of humanity. It is now the fiftieth year of the establishment of Sunday Schools, and it appears, by a public announcement, that their patrons and promoters have resolved to celebrate the epoch in a manner worthy of their high character. They have most fitly determined, that it shall be celebrated on the day of the founder's birth—and, in accordance with the period of time which has elapsed since their establishment, it is to be called the *Sunday School Jubilee.* The idea of this celebration is attributed to Montgomery (we mean Montgomery *the* poet), and it does equal credit to his head and heart. The better to mark the event, and to add to the means of carrying into effect the benevolent designs of Mr. Raikes, it is proposed to establish on the occasion a fund of 10,000*l.*, for the purpose of erecting sufficient school rooms, which may be used both as Sunday and as Infant schools. The festival seems to be, in every respect, extremely well planned, and graced as it will probably be, by the presence and assistance of many of the first men of the age, can scarcely fail to make a most useful impression on the public mind. When we reflect, with what noise and exultation the sanguinary victories of warriors, and even the triumphs of mere political dexterity, are usually applauded—when we see the birth days of men of blood, of ambitious statesmen, and of luxurious monarchs, figuring as red-letter days in our calendars—we should feel ashamed of the state of that society in which our lot is cast, were there not enough of a better sort of feeling existing, to do due honour to a day set apart for the commemoration of so great a work of love and charity, as that which is identified with the name of Robert Raikes.

T. M. B.

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MESSRS. BRAITHWAITE AND ERICSSON'S BOILERS.

Sir,—Allow me to express my fears, that the successful performances of the Novelty locomotive-engine on the Liverpool Railway, are not destined to produce any practical results, and that Messrs. Braithwaite and Ericsson's boilers do not answer at all in practice. Here is an instance:—One of their boilers, with a 10-horse power high-pressure engine, has been some time at work on the premises of a celebrated builder near Regent-square. The cylinder is 10 inches diameter, and stroke 2 feet; it drives a 36-inch circular saw, raises water by means of a three-throw pump 180 feet, and blows a few smiths' bellows. The total power of the engine is estimated to be equal to that of 10 horses. *But*, it consumes a chaldron of gas coke per day *always*, and sometimes more—the pressure of the steam ranging from 50 to 60 lbs. per inch. Gas coke is now worth 18*s*., I believe, at St. Pancras, and then the cartage must be added, say 2*s*. which makes 20*s*. for the daily consumption of fuel by an engine, called by its makers, one of 10-horse power. Now, a 10-horse power Boulton-and-Watt engine, consumes only one bushel of Newcastle coals per hour =12 bushels per day—and they may be had at most at 39*s*. per chaldron=1*s*. 1*d*. per bushel: so that a Boulton and Watt engine may be worked at a much cheaper rate than these *Novelties*.

There appears to be a fault about the above-mentioned engine, which you mentioned in your review of Mr. Wood's Treatise on Railways, as having existed in the engine made at Darlington, which competed for the prize on the railway, namely, that the draught of the chimney is too great. It is a general practice when coke is used, to break it into small pieces before putting it into the fire; but in this case, if the coke is broken into small pieces, they are carried up the chimney.

I long very much to see a cheaper-working engine than a well-made condenser, working expansively; but I very much fear it will be some time before my longing is satisfied.

Yours, &c. J. B.

Remarks.

We mentioned in the Interim Notices in our last number, that as the above letter was anonymous, we thought it proper to make enquiry into the correctness of the statements contained in it. We shall now lay the result before our readers, and shall merely observe, in regard to it, that though it negatives altogether the most material of our anonymous correspondent's statements, we are by no means disposed to impute to him any intention to deceive. The circumstantial and dispassionate character of his letter, inclines us rather to infer, that he must have been himself misled by some ignorant or malicious informant.

The working-engineer in attendance on the engine referred to, whose name is Thomas Elliot, having been requested to inform us of the work performed by it, during three days, which we specified at random—the following is his report.

"June 17th, 1831—The engine heavily worked from six in the morning till half-past five afternoon—deducting an hour and a half for meals; pressure, 50 lbs. per inch; strokes, 50 per minute. Days consumption of coke, *between nine and ten bushels*.

"June 18th.—The same as the day preceding.

"June 24.—Going the whole day, except at meal times; but the work rather light.—Day's consumption of coke, *eight and a half bushels*.

"When the engine has not much work to perform, the consumption of coke is about eight bushels per day; at other times it averages nine bushels; and, on no occasion, exceeds ten.

"It is computed, that the saving in fuel effected by this engine, amounts to from 13*l*. to 15*l*. weekly."

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IMPOSSIBILITY OF THE INFINITE DIVISIBILITY OF A FINITE QUANTITY OF MATTER DEMONSTRATED. BY SHELDON CLARK, ESQ.

(From the American Journal of Science.)

Truth is always consistent with itself. Any proposition which involves an impossibility, cannot be true. Says one, I will draw a line from A—to—B; and if you will move your penknife first over half of it from A to B, and then over half the remainder, and again over half the remainder, and in the same ratio keep moving your knife, as fast as you can, and you can never move it from A to B. Experience proves that one can move his knife from A to B; and what experience proves is always true: therefore, the proposition involves an impossibility. The proposition is predicated on the opinion, that every finite line contains an infinite number of parts of smaller lines, which can be divided *ad infinitum.* But it is impossible that a finite line can contain an infinite number of parts, or smaller lines; for any number of equal parts into which every finite line can be divided, will be a definite number of parts, of equal lengths; and all the parts being equal to the whole, if you keep constantly taking the parts of a finite quantity, you will, if you take fast enough, eventually take the whole. If you first take half the parts, and then half the remainder, and again half of the remainder, and so on, according to this ratio, you will eventually have but one part left, out of any definite number of parts whatever. If the line be divided into parts as small as they possibly can be, so small that no one of them can possibly be any smaller; if you have moved the knife to within the least possible part of the end of the line, or over all the definite parts of it but the very last one; if this last remainder be the least possible part of the line, how can it be divided into less remainders? If it is now the least possible part, how can it be divided into less parts? Suppose you put the point of your knife on the end of the line at B, and move it the least possible part of the line towards A, is it not clearly perceived by the mind, that the part moved over is as small as any part possibly can be; that it cannot contain parts smaller than itself? for no part can be less than the least possible; therefore, the least possible part is indivisible. For this reason, when there is but one part of the line left, and that the least possible, if you move the knife any further you must move it to the end of the line. It is asked, if the least possible part of the line has not a beginning, a middle, and an end? Every indivisible part has a beginning and an end; but there is no absolute distance between them, though the beginning and the end together make absolute distance. The least possible part is so small that it cannot be divided into halves, each of which shall have a beginning, a middle, and an end, and an infinite number of smaller parts; which is proved by the fact, that we can move over it. Whereas, if the least possible part of any line did contain, and could be divided into, an infinite number of infinitely divisible parts, and we were to move, as we necessarily must, first over half these parts, then over half the remainder, and so on in this ratio, we could never, to all eternity, move over all the parts of the least possible part; for there would always be half of a remainder left. But the fact is, there is no absolute distance between the beginning and the end of the least possible part, for such a part itself is as indivisible as the centre of a circle. The impossibility involved in the proposition is, that the last remaining part cannot be divided into halves. Therefore, when in moving over any finite line, we have moved over all the least possible parts of it but one, if we move any further, we must move over that one, which brings us to the end of the line.

N. B.—The reason why the lines of the asymtotes will never come in contact, is because they approach each other so slowly. According to the nature of their approaching, it must take to all eternity for them to touch each other. Suppose that one should move so slowly that it would take to all eternity to go from his house to his office, how long would he be in going half the distance? Would he be as long as he would be in going the whole distance?

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THE CATECHISM OF IRON, OR THE MERCHANT AND MECHANICS' NEW AND COMPLETE GUIDE TO THE IRON TRADE. WITH PRACTICAL REMARKS AND USEFUL OBSERVATIONS, INCLUDING A NEW AND COMPREHENSIVE SET OF TABLES. BY BENJAMIN LEGGE. London: Longman and Co.; Tipton T. Danks. pp. 180.

This is an exceedingly useful and meritorious work. It contains a vast body of practical information, which it must have cost the author a great deal both of labour and reflection to collect and methodize. We are not aware of any other publication, so well calculated to serve as a manual to all persons engaged in the iron trade, or in those numerous manufactures of which iron forms the basis. The author affects not to be either chemically or mathematically exact in his statements; all that he claims credit for —and which credit we must freely allow him—is that of having furnished an accurate and faithful digest of those rules of practice, by which the makers and the buyers of iron are guided in their dealings with each other. The following extract from his "Catechism" will suffice to exemplify the useful character of the information which it conveys:—

> "Q. How are the distinct qualities of iron known?
>
> "A. First, the most useful quality of common iron may be known by the equable surface of its body, which is free from transverse fissures or cracks on its sides or edges; or when broken by a clear grey colour, without any glossy particles, and of a fine texture, which separates with a very fibrous appearance. The second quality is rather tough when heated, but brittle when it is cold; it is known by the shining glossy particles on its face when broken, and having little or no appearance of a fibrous texture; this is generally called by manufacturers 'Cold Short Iron.' A third quality is called 'Red Short,' or 'Hot Short;' this is very brittle when it is hot, and more tough when cold; this quality may be known by the dark brown appearance of the scale which adheres to its body, and by the fissures and cracks on the edges and corners of bar-iron, and if broken, its internal colour is dark and very open in texture.
>
> "Q. Are there any superior qualities besides those already enumerated?
>
> "A. There are improved qualities which are termed 'Best Iron.' The most approved kind is known by its smooth blue surface, and the light scale which shells off in cooling, and by the fine-grained fibrous texture which appears in the part separated; its colour should be a clear light gray, without any dark spots or glossy particles on the face of its body when broken."

Following the "Catechism," which extends to 68 pages, there are 112 pages occupied by "Tables of the Weights of Flat, Square, and Round Bars, Boiler-Plates, Sheet-Iron, Hoops, and Strip-Iron—By Measure on the Rule, and by the Numbers on the Wire-Gauge; with the nearest Proportionate Number of Feet equal to a Ton in weight of the different Sizes."

We shall not, we are sure, endanger the estimation in which this work deserves to be held—in the mind of no reader at least of the Mechanics' Magazine—when we mention, which we do on the authority of the author himself—that he was originally no more than a common miner—uneducated and (but too probably) unbefriended — "whose best years for learning and improvement were nearly all past in following the occupation first assigned to him *beneath the surface of the ground.*" It must delight every person of liberal feelings, to contemplate so praiseworthy an instance, of a man of humble genius, emerging by his own efforts from the obscurity—the literally profound obscurity—in which the accidents of fortune had placed him. We are glad to perceive that his work has reached a second edition; and trust he may reap from it much both of profit and of fame.

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REMARKS UPON LANDSCAPE PAINTING IN WATER-COLOURS; EXTRACTED FROM THE COMMON-PLACE BOOK OF AN AMATEUR. 23 pp. 8vo. Houghton and Co. 1831.

We think (but are not sure) we recognize in these "Remarks," the hand of an old and esteemed correspondent, and presume we must ascribe to the enthusiastic admiration which he expresses for the delightful art, the practice of which he has here undertaken to elucidate, his recent alienation from those severer studies, which, in times past, obtained for us the honour of his correspondence. We are but little versant in the subject-matter of these "Remarks;" but we can at least bear testimony to their being conceived in good taste, and clothed in agreeable language. Of the kind of instruction which they convey, we shall leave our friends of the Water Colour Exhibition, to judge from the following specimens:—

> "*Foliage.*—It is not the number of leaves that give quantity, but variety in their size, tone, distance, depth and colour; for a small variety of leaves and

weeds appears more numerous than a great quantity of the same kind. The neglect of this principle is one of the reasons why those trees, which are so much laboured, give offence, rather than pleasure, to an experienced eye, and it appears to have been, in many instances, the fault of Zuccarelli, who, though he executed his objects with masterly touches, yet was too apt to make the leaves of his trees equal in size on every side, which fault is perpetuated in many engravings from his works; and this always causes a tree, however well executed in form, to appear artificial."

"*Taking out Lights.*—The following method is much simpler (than that of Nicholson) and of equal efficacy. With an ivory pallette-knife grind a little pipeclay in weak gum-water, dilute it to the consistency of paste; after spunging the paper, previous to laying on the colours, cover the high lights with this mixture, and work up the drawing as usual. To take out the lights, gently moisten the surface of the paper; when the mixture will continue wet after the surrounding parts are dry; then with a white handkerchief, take up the composition, which will leave the lights perfectly clear."

"*Prout's Drawings.*—The finishing touches in Prout's Architectural Drawings are given with a reed pen, which he makes also free use of in his foliage. His colouring is thin and a little marked with mannerism; yet for true taste in design and brilliancy of execution: his paintings find no parallel among the works of contemporary artists."

The author concludes his collection of "Remarks," with a very humane suggestion, which admits of an application to a great many other persons besides water-colour artists and amateurs.

"Amateurs in particular, are too fond of drawing on a table, the stooping posture is highly injurious to health, which would not only be remedied by making use of an easel; but a little practice would give more freedom of execution, in addition to the greater ease, with which washes are laid on, than on a comparatively flat surface; and the position of the painting in regard to the eye, would be much improved."

TEAK TIMBER.

The advocates for a foreign supply of timber dwell largely upon the excellence of the Malabar forests; and in this we, from experience, cordially join them. The *tectona grandis*, or teak tree, though designated the Indian oak, is quite of a different family; its immense height and large leaves give it a more majestic aspect, and its timber is even preferable for naval purposes. This is saying much; but as we have had opportunities of personally witnessing its durability under exposure to all varieties of climate, we feel confident in the truth of the assertion. This timber contains in itself an oily protection from putrefaction; and it is destitute of the gallic acid by which oak corrodes iron and attracts worms; nor does it nourish the vegetable abortions which create the dry rot. The variety of it called *puon*, from its mild and straight grain, is very superior for masts, to Jublanaz, Riga, American, or indeed any other known wood. The weight is against it for topmasts; but we were in a ship, where, on the suggestion of the well-known Jemsatjee Bomanjee, it was tried with success. "If you get it aloft," said he, "it will never go without the lower masts." We remember seeing at Bombay a fine country ship of about 500 tons burthen, which was constructed of teak upwards of forty years before, and was then found to be in perfect condition, and without the slightest weakness or ailment. We ourselves sailed in a frigate, built of this material, for four years, in various stations, and upon arduous service, which would have destroyed any of our contract ships, and yet we left her as sound as a new ship. In 1811, the Dover, a less substantial teak ship than the one just alluded to, was driven on Madras beach, and stranded during a furious gale of wind. So strong was this vessel, that she laid in the overwhelming surf several months perfectly entire, and in a part where few European ships would have held together for a week; carpenters were then employed at a great expence to break her up, but the work proved so difficult that they were at last obliged to blow her to pieces with gunpowder—*United Service Jurnal, for August.*

MISCELLANEOUS.

Large Mass of Coal.—It appears from a Report of the Lehigh (United States) Coal and Navigation Company, "that the quantity of coal on the land of the company is supposed to be equal to a four equal sided prism of 500 feet on each side, and seven miles in length." The report adds, that this "is the largest body of coal known." The coal alluded to, is a remarkably pure anthracite, which burns without odour or smoke.

Eruptions of Mud.—It has been affirmed by different authors, that during the eruptions of Mount Ætna in 1822, it belched forth columns of mud. An American writer, Mr. Isaac Lea, who personally witnessed this rather incredible phenomenon, states, that in reality, nothing came up from the depths of the earth, save columns of carburetted hydrogen gas, but that the argillaceous chalk, of which the mouth and sides of the crater are formed, being reduced to a state of mud by the copious showers of condensed vapour, which usually attend volcanic eruptions, the force of the ascending columns of gas, caused the soil with which they came in contact, to flow over the sides of the mountain in muddy streams. Mr. Lea adds, that in times of drought, nothing but dust is ejected.

An Eye to Business.—We have been much amused by reading in *The Times*, a letter signed "John Barton," in which the writer calls loudly on the public authorities to bethink them of the great risk the country runs of having the cholera morbus introduced into it through the practice, still (alas!) too common among steam-vessels, of using pistons packed with hemp, instead of metallic pistons! The humanity and shrewdness of this warning, are not more worthy of admiration than the extreme delicacy which has prevented the writer from adding, "And should the public authorities be therefore pleased to ordain, that henceforth nothing but metallic pistons, shall be used on board of steam-vessels, I beg to mention, that the best metallic pistons ever invented, may be had of me, JOHN BARTON, PATENTEE, &c."—We have a high respect for Mr. Barton, and think well of his metallic pistons; but we detest all humbug, no matter in whose or in what behalf it is employed. Mr. Barton might, with as good reason, raise an outcry against hempen sails and cordage, as against hempen packing.

Adulterated Coffee.—Persons desirous of ascertaining whether coffee is pure, or whether succory has been mixed with it, will find the following an infallible test:—"Let a small glass vessel be filled with cold water and a pinch of the coffee thrown into it. If the water remain transparent, and be not in the slightest degree discoloured, the coffee is pure; but should the liquid become tinged with red, and red particles fall to the bottom, as in the case of sugar when being dissolved in water, it is a sure proof that the coffee has been adulterated with succory.—*Journal des Connaissances Usuelles.*—[This notice may be of considerable use in detecting and defeating the practice now becoming very prevalent of adulterating coffee with succory. It has been clearly ascertained, that succory contains no nutritious properties that should make it a substitute for coffee; although it is quite true, that a small tea spoonful of succory, if added to an ounce of coffee, will improve the flavour, and render the liquid clearer and of a more bright colour.]

Roman Fancy Bread.—The price of bread in Rome, when Pliny lived, was nearly the same or a little lower than it usually is in our day in London. The Romans made bread of very different qualities and prices. Pliny enumerates four descriptions of them —viz. *Ostrearii*, or loaves baked with oysters; *Artolagani*, which correspond with our cakes, or rather rolls; *Speustici*, from the quick mode of the preparation; and *Artopticii*, or those baked in ovens, so called from the kind of furnace in which they were prepared. This last must have been of nearly the same quality as our middle sort of wheaten bread, and was sold, according to the calculation of Arbuthnot, at the rate of three shillings and twopence the peck loaf.

Renovation of Alcohol.—It appears from some experiments of MM. Accarie and Chevalier, that alcohol which has been employed in the preservation of animal matters, is easily disinfected by adding to it small quantities of chloruret of lime, until the putrid odour has disappeared. It is then to be distilled, and the product may serve for the preservation of new substances, or for any other use in the arts.

To dissolve Copal, as commonly done by means of alcohol, is a very tedious process; but if a little camphor is previously dissolved in the alcohol, the solution may be effected in half the time.—N.

Dissection in Slave Countries.—In a Prospectus of the South Carolina Medical School we meet with the following passage:—"Some advantages of a *peculiar* character are connected with this Institution, which it may be proper to point out. No place in the United States offers as great opportunities for the acquisition of anatomical knowledge, *subjects being obtained from among the coloured population in sufficient number for every purpose, and proper dissections carried on* WITHOUT OFFENDING ANY INDIVIDUAL IN THE COMMUNITY!!" The coloured population, then, according to the Faculty of South Carolina, form no part of *their* "community." *They* have no feelings to be respected or offended!!! You may cut up and mangle them as you please; *they are but Blacks*, and no more to be regarded than any *other* beasts of the field. Of a truth, slavery must have a most debasing and hallucinating influence on all around it, when men of a liberal profession can talk thus of beings created with like feelings, affections, and *rights*, to themselves. It is singular to think, that notwithstanding the white-skin pride of birth of these cat-o'-nine-tail gentry, they should have found out that, after all, a dead black man is quite as good as a dead white man for every purpose of anatomical inquiry—has the same bones and sinews; the same veins and arteries; has the self-same sort of vital fluid; and (perhaps) all but the same sort of—*heart*. Death is, indeed, a great teacher—a mighty leveller of distinctions!!

Specific for the Cholera.—A gentleman who holds a high office in the civil service of the East India Company, and arrived in June last from Madras, was at Masulipatam in 1825, where the cholera prevailed, and where circumstances obliged him to give what aid he could in the exigency. He states, that the means of cure employed was to administer cajeput oil as early as possible on the appearance of the symptoms, in doses of from 25 to 30 drops in about half a wine-glass full of warm water; the latter dose repeated in half an hour, when the symptoms did not give way to the first dose. When the stomach rejected the first dose, 50 drops were given instantly. The success was extraordinary, one case only out of 110 having proved fatal. The medicine was not repeated after the symptoms had subsided. Recovery was usually very rapid, and no other medicine was found necessary. These facts have been communicated to Prince Lieven, who has forwarded a copy of the statement of them to his Government.—*Morning Chronicle.*

INTERIM NOTICES.

It has been thought advisable to incorporate the observations intended for our present Number on the Opening of the New London Bridge, in a Pamphlet, which will appear on the subject next week; and from which we shall give such extracts as will render the series of articles that have appeared in the Mechanics' Magazine, on the history and progress of this public work, complete.

Communications received from P. H.—Mr. Deacon—John—X. E. S.—The Ghost of St. Magnus—A Westminster Scholar.

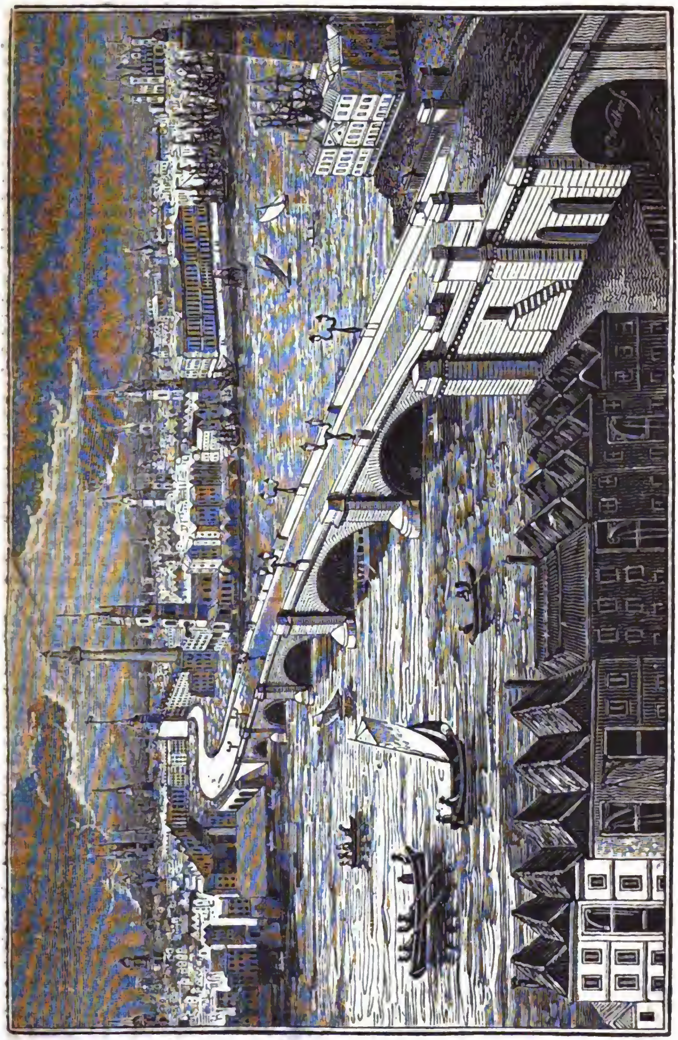
LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office Court, Fleet Street; where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 418.] SATURDAY, AUGUST 13, 1831. [Price 3*d*.



A PROFESSIONAL SURVEY OF THE OLD AND NEW LONDON BRIDGES, AND THEIR APPROACHES, INCLUDING THE MOST INTERESTING HISTORICAL MEMORIALS OF BOTH STRUCTURES, WITH REMARKS ON THE PROBABLE EFFECTS OF THE CHANGES IN PROGRESS ON THE NAVIGATION OF THE THAMES. pp. 36, 8vo. With Thirteen Plates, and a Vignette Portrait of John Rennie. Price 2s. 6d. London: M. Salmon.

The above is the title of the pamphlet to which we alluded in our last number, as being in the course of preparation. The late period of the week at which this "Professional Survey" has been completed, puts it out of our power to do more at present than lay before our readers a few extracts.

The readers will doubtless remember the discussions to which the conduct of the Corporation of London, with respect to the choice of a plan for the new bridge, gave rise. The case was briefly this:—Shortly before the passing of the Act, the Corporation offered premiums of 250*l.*, 150*l.*, and 100*l.*, for the three best designs for a new bridge; and the designs, furnished in consequence of this invitation were referred to Messrs. Nash, Soane, Smirke, and Montague, who awarded the first premium to Mr. Joseph Gwilt. The Corporation refused to abide by this decision of their referees, and assigned the first premium to Mr. Charles Fowler; the second to Mr. T. Borer; and the third to Mr. C. A. Busby, —not even awarding to Mr. Gwilt the lowest of the premiums offered! The Corporation then produced another plan which had been prepared for them beforehand, by Mr. Rennie, and declared that this was still better than any that the public competition had called forth! The Act accordingly ordained that the new bridge, to be erected, should be a bridge according to this plan by Mr. Rennie. And all this the writers of the present "Survey" contend was perfectly right. The view they take is at least new:—

"The conduct of the Corporation, in this matter of the plans, has been much censured; but more so than we think it strictly deserves. It has an appearance of greater impropriety than really belonged to it. We think Mr. Gwilt was used ungenerously—perhaps unfairly—and that Messrs. Nash, Soane, Smirke, and Montague, were very deliberately insulted; but we can carry our censure no farther. However natural it may have been for the competitors to expect that the plan, which obtained the first premium, should be that ultimately adopted, we cannot discover that the Corporation came under any obligation to that effect; and we should have thought it very unwise in them if they had. A plan may be the best of a great many presented, and yet not so good but that a much better may be found. Although, therefore, Mr. Gwilt may have had good cause to complain that the premium, awarded to him by his professional brethren, was withheld from him by a committee of revision, composed of mere merchants and tradesmen, it by no means follows, that he has more than the loss of the premium to impute to Corporation presumption. Even the gentleman to whom his laurels were transferred shared no better than himself, as regards the ulterior distribution of favour and employment. Every thing, in a case of this sort, depends on the ultimate result. Was the plan, which the Corporation preferred, really the best? Humble as their qualifications, to appreciate a work of art, may have been,—little even as judgment and taste may have had to do with their decision,—it will, doubtless, suffice, for the satisfaction of the public mind, that somehow or other they judged rightly in the end. For our own parts, we are decidedly of opinion that *Mr. Rennie's plan was the best.*"

The authors then describe Mr. Gwilt's plan, and state the following objections to it:—

"We readily admit, that there would have been great elegance in a structure of the form and dimensions exhibited in these plans of Mr. Gwilt; but, without stopping to inquire whether it would have been equal, in this respect, to the bridge actually erected, after the designs of Mr. Rennie, we shall merely remark, that the selection of the segment of a circle for the form of his arches would have been, with us, reason enough for its rejection. "Some people," says Dr. Hutton, "prefer the semi-circle for the figure of the arches; *though, perhaps, without knowing any good reason why.*" The truth is, it is one of the worst forms that can be employed; and an arch, of any segment of a circle, is only less objectionable in degree. The preference so long given to this form, in bridge building, was one of those vulgar errors which the investigations of science have happily exploded, and which it is rather surprising any person should have proposed to revive, after the successful examples of elliptical construction, exhibited in Blackfriars and Waterloo Bridges. The elliptical arch has been shown to approach nearer than any other to that theoretical perfection of form in which all the parts are in equilibrium, having no tendency to give way in one part more than another. It is, therefore, more uniformly strong than any other sort of arch. It requires, at the same time, less materials, and is consequently lighter and cheaper. Farther, it admits of greater elevation in the haunches, in conjunction with greater flatness at top, and may be made of any height to the same span.*"

The inclination of brother architects to favour Mr. Gwilt is thus accounted for:—

"We have reason to believe that much of the indisposition which prevails among professional men to admit the inferiority of Mr. Gwilt's design, arises from a notion, that when the Corporation advertised for plans, they had already *decided* on adopting that of Mr. Rennie, and that the competition, therefore, was all a farce, got up to give an appearance of fairness and impartiality to their proceedings, in utter disregard of the hopes which it might excite, or of the feelings which it might lacerate. We see no reasonable ground, however, for entertaining such a suspicion; and believe most sincerely that none exists. Granted, that the Corporation had Mr. Rennie's plan already in their hands, and were well satisfied with it, was it not natural that they should be desirous of ascertaining, by some decisive test, whether a better could not be obtained? And what surer test could they adopt than to invite all the genius and talent of the country to an open and public competition? Among superstitious people, the good marksman is always sure to fire with a charmed bullet: it would be to judge the Corporation by the same rule, were we to conclude that because they happened to hit the mark at once, their success must be owing to some secret and unholy confederacy."

The inscription on the plate deposited in the foundation-stone of the new bridge, written by Dr. Coplestone, the present Bishop of Llandaff, is severely handled; but to appreciate the following remarks, the reader must refer to our 329th Number, where they will find a copy of the inscription criticised:—

"Neither the matter nor the style of this inscription can be much commended. It is Dr. Johnson, we believe, who observes that an epitaph ought at least to contain the name of the person whose virtues it is intended to hand down to posterity; and under the shield of his authority, we may venture to assert that it is a blundering inscription for a bridge over a river, which never once mentions the name of that river. Dr. Coplestone speaks of "*the* river" in the style of a citizen who had never seen nor heard of any other. The Act for building the bridge affirmed, as we have before seen, that it was by reason of "the large starlings and piers" of the old bridge, that "the navigation was rendered dangerous and destructive to the lives and properties of his Majesty's subjects;" Dr. Coplestone asserts, that it is "by reason of the force and rapidity of the current." We wonder who gave his Lordship authority thus to deviate from his text. It matters, indeed, not much; for the one version of the affair is just as false, in respect to the loss of life and property alleged, as the other. Dr. Coplestone further asserts, that it was "under the sanction of parliament" that the City resolved to erect a bridge "upon a foundation *altogether new*." It is a fact incontestably established, that the City adopted a new foundation or site in the very teeth of the sanction of Parliament.* The inflated expressions, with which the inscription concludes, about the "time" chosen for the undertaking being so "suitable," on account of "the flourishing in glory, wealth," &c. of the British empire, will, at some future day, contrast strangely with the fact that the date subjoined to this piece of *fanfarronade* is the same "year of our Lord" which is known in the chronicles of Britain by the name of "the year of the panic," when ruin and dismay stalked through the land, and this most "flourishing" nation seemed verging on a state of general bankruptcy! Dr. Coplestone would probably have offended good taste and the integrity of history less, had he strained less after momentary effect—had he thought more of what posterity would think, than of what his turtle-feasting friends of the Corporation would like to hear. Truth requires not such blown bladders to float it down the stream of time, as the worthy bishop seems to have been at pains to provide. The time when the structure was erected—the persons by whom—and the government under whose auspices;—these were the only things which it was needful to record; and recorded they might have been in as many words as Dr. Coplestone's inscription has lines. The merits of the bridge, and the prodigious public spirit of its founders, it might have been safely left to that bridge itself to vouch and proclaim. The inscription besides, in being thus docked and simplified,—reduced to few parts, and these parts divested of all frippery,—would have been more in accordance with the noble character of simplicity which belongs to the structure it was designed to honour."

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* Hutton's Principles of Bridges.

* It has been usual to enclose in the foundation stone of every structure like this, a copy of the Act of Parliament empowering its erection. Was it to avoid handing down to remote posterity two such conflicting memorials of the origin of New London Bridge, as the Act of Parliament for its erection and Dr. Coplestone's inscription, that the practice was departed from in this instance?

The pamphlet is illustrated by twelve plates; from which we have selected, by way of specimen, the excellent view of the New London Bridge from the Southwark shore, which ornaments the front-page of our present Number. A good vignette likeness of the late Mr. Rennie is also given in the title-page.

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CABINET CYCLOPÆDIA. OPTICS. HYDROSTATICS. PNEUMATICS.*

Science, according to many—perhaps the majority—of the modern professors of it, has, of late years, prodigiously declined in Great Britain, in consequence, say they, of men of science being neglected in the distribution of the public patronage.

These grumblers will have it, that we must infallibly retrograde in the grand march of mind, unless the most brilliant honours in the gift of the sovereign, and the highest offices of the state be bestowed on chemists, mathematicians, geologists, mineralogists, etc., etc., etc., instead of gentlemen of large estate, or high birth, good speakers in 'the house,' or 'dogged men of business.' If we are to believe all they say, the government of this country, not only never thought of bestowing a good thing of this kind on a man of science; but absolutely, out of the thousands at its disposal, never appropriated a single farthing to the furtherance of improvement in any one branch of philosophy! And hence this dire consequence, that a man devoting himself to the pursuits of science in this enlightened nation, and in this second quarter of the nineteenth century, must either live upon his own ruminations and theories, (not, perhaps, very digestible stuff) or fairly starve!

Now this was putting the case rather too strongly: it may be admitted, without much difficulty, that science receives very little direct pecuniary encouragement in this country; but, on examination, it will turn out that it does quite as indisputably, receive *a little*. For instance, let us take Mr. Babbage, the gentleman who has put himself at the head of the malcontents: does he not delight to indite after his name, even in the title-page of his doleful Jeremiad, "Lucasian Professor of Mathematics in the University of Cambridge"? True, this is not a government office, but it is one of a public nature, and, we suppose, not without its emoluments, of some sort or other. Then, again, is he, or is he not, the same Charles Babbage, Esq., to whom a sum of some twelve thousand pounds sterling has been voted by the House of Commons, to enable him to bring to perfection a certain calculating machine, which is to do wonders when it is completed! If this be not giving some encouragement to science, what is? At any rate we think Mr. Babbage should be the last man to complain. Again, Dr. Brewster, the author of the Treatise on Optics, which forms one of the works under review, is another, and one of the most strenuous of these complainants—and yet we recollect, in looking over the enormous pension list, published some months ago, meeting with the name of "David Brewster," as the receiver of a snug little income from government—to what amount we do not exactly recollect, but, we think, almost sufficient to rescue the worthy doctor from the fear of perishing from actual starvation.

But then, it seems, Mr. Babbage and his coadjutors are ambitious of title, as well as of riches,—they sigh for such distinctions as are now awarded to eminence in the camp or in the cabinet,—or at least, such as wait upon crown lawyers and lord mayors! What harvest can those who cultivate science from such a motive expect to reap? What height in philosophy can he attain to, who would rather be *Sir Isaac, Master of the Mint, and one of his Majesty's most honourable Privy Council*—than NEWTON?

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* A Treatise on Hydrostatics and Pneumatics: by the Rev. Dionysius Lardner, LL.D., F.R.S.—Pp. 353.

A Treatise on Optics: by David Brewster, LL.D., F.R.S., L. and E., &c.—Pp. 383.

London: Longman & Co., and John Taylor; small 8vo., price 6s. each. 1831.

But, after all, may we not be in the situation of the Royal Society when hoaxed by Charles the Second? In other words, has science so terribly declined in England, as its querulous professors would have us believe?

In Politics, we very well know, every nation occasionally takes it into its head that it must be 'the laughing stock of Europe,' and, in every negotiation, each nation thinks itself overreached. The English are peculiarly subject to this weakness, and we are afraid it has extended from the affairs of state to those of science. At any rate, this is the conclusion we are tempted to draw from the curious fate of the English translation of Cuvier's 'Animal Kingdom.' Mr. Griffiths, the English editor, is bespattered with *quant. suff.* of critical indignation by an English reviewer (Mr. Loudon), while the French conductors of the *Revue Encyclopedique* are equally severe on the original author, M. le Baron Cuvier, whose work they condemn as a mass of dryness, intolerably dull in the original, and only rendered worth reading by the English additions; additions which excite Mr. Loudon's deepest disgust! Who shall decide when Doctors disagree? One of these "learned Thebans" deplores the state of science in France, and thinks they manage these things better in England; while the other does just the reverse! What conclusion, then, can we come to? Simply this, that matters are not so bad as they are represented by either party; and that if they were, no assistance from the "powers that be" could set them right again. It is a consolation, too, to reflect, that what science we do possess, in these degenerate days, is far more extensively diffused than in those times so deeply regretted; and that our falling-off, if any, is only in those departments least intimately connected with the comfort and happiness of the mass of mankind.

We have seen that Dr. Brewster is one of the chief champions of the Declinarians at least, he is usually supposed to be the author of an article in one of the late Numbers of the Quarterly Review, which expounds that doctrine with great vehemence, and from which the quotation prefixed to the Doctor's own treatise on optics is taken; it is as follows:—

> "It is not easy to devise a cure for such a state of things (the declining taste for science); but the most obvious remedy is to provide the educated classes with a series of works on popular and practical science, freed from mathematical symbols and technical terms, written in simple and perspicuous language, and illustrated by facts and experiments which are level to the capacity of ordinary minds."—*Quarterly Review for Feb.*

Now, as this elegantly-written sentence faces the frontispiece of a work written by the author of that sentence himself, we are entitled to expect in that work a little of the freedom from "mathematical symbols and technical terms," which he considers so great a desideratum. Nevertheless, we have the usual abundance of complex calculations, and the usual quantity of jargon about refrangibility, catoptrics, dioptrics, &c. &c. &c. In exemplification of this latter defect, we have noted for extract a short notice of an invention by the late Dr. Wollaston:*—

> "Dr. Wollaston introduced a new kind of spectacles, called *periscopic*, from their property of giving a wider field of distinct vision than the common ones. The lenses used for this purpose are *meniscuses*, in which the *convexity* predominates, for long-sighted persons, and *concavo-convex* lenses, in which the *concavity* predominates, for short-sighted persons."—P. 321.

Here is food for ordinary minds; here is simple and perspicuous language; here is freedom from technical terms, with a vengeance! We would advise the Doctor to search in some *other* philosopher's works for the motto of his next work on "popular and practical science!" At present he seems to be in a most absurd position—that of laughing at himself.

The most powerful sensation produced by an inspection of the treatise on optics, is one of regret, that its execution had not been entrusted to the author of the "Introductory Discourse on the Study of Natural Philosophy," the man, of all others, likely to produce such a work as the Doctor has described, but failed—it would seem, hardly endeavoured—to produce. *He* would have aptly relieved the dryness of detail by the amusing relation of modern instances and facts which are level to the capacity of ordinary minds—a thing almost entirely neglected by our present author. Almost the only narratives of this description are those in illustration of the phenomena of "unusual refraction," about the middle of the volume—all before and after is confined to strict technicality, and, of course, destitute of attraction to the general or casual reader. From this part we take an interesting extract:—

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* By the way, Dr. W. never, as we are aware, received a farthing from Government; yet he lived in affluence, and died worth many thousands of pounds—all gained by science!

> "Captain Scoresby, when navigating the Greenland seas, observed several very interesting cases of unusual refraction. On the 28th of June, 1820, he saw from the mast-head, eighteen sail of ships at the distance of about twelve miles. One of them was drawn out, or lengthened, in a vertical direction; one had an inverted image immediately above it; and other two had two distinct inverted images above them. accompanied with two images of the strata of ice. In 1822, Captain Scoresby recognised his father's ship, the Fame, by its inverted image in the air, *although the ship itself was below the horizon.* He afterwards found that the ship was seventeen miles beyond the horizon, and its distance thirty miles. In all these cases, the image was directly above the object; but on the 17th September, 1818, MM. Jurine and Soret, observed a case of unusual refraction, where the image was on one side of the object. A bark, about 4000 toises distant, was seen approaching Geneva by the left bank of the lake, and at the same moment, there was seen above the water, an image of the sails, which, in place of following the direction of the bark, receded from it, and seemed to approach Geneva by the right bank of the lake: the image sailing from east to west, while the bark was sailing from north to south. The image was of the same size as the object when it first receded from the bark, and was only one half that of the bark, when the phenomenon ceased."—Pp. 258-9.

This is something in the style of Mr. Herschel; but, in the more essential part, the explanation of the causes of unusual refraction, the Doctor is by no means so happy. Had it not been so long, we should have quoted it—it is almost as full of unintelligible, technical terms, as the notice of the Periscopic spectacles:—

So much for "optics;" but we have another treatise to notice, that on "hydrostatics and pneumatics," which is written by the learned Editor of the Cabinet Cyclopædia, Dr. Lardner. Their chief deficiency is one we should not have looked for—that of novelty. For instance, the remarks on rapid travelling by canal are so out of date, as to be rendered almost ludicrous after the experiments on the Forth and Clyde Canal, narrated in a recent Number of the Mechanics' Magazine. On the whole, however, the work forms a valuable compendium of information on the subjects to which it refers. We subjoin an extract, for a double purpose—to give some notion of the author's style, and to enlighten some of our perpetual perpetual-motion seekers:—

> "It may appear, at first view, that the pressure of the atmosphere sustaining the column of water in the suction-tube, furnishes an aid to the power which works the pump. This, however, is not the case; at least, not so in the sense in which it is commonly understood. To make this intelligible, it will be necessary to consider somewhat in detail the forces which are in operation during the process. There are some forces which are directed downwards from the top of the syringe towards the bottom of the well, and others which are directed upwards. Now, it is evident, that the mechanical power applied to draw the piston up will have to overcome all that excess by which the forces downwards exceed the forces upwards. Let us suppose a column of water resting on the piston, after having passed through the valve *v* (the valve in the piston. The upper surface of this column is pressed upon by the weight of the atmosphere: the piston has, therefore, this weight to sustain. It has also to sustain the weight of the water which is above it. The atmospheric pressure acting also on the water in the well, is transmitted by the quality of liquids explained in hydrostatics, chap. 2, (equal pressure in every direction) to the bottom of the piston; but this effect is diminished by the weight of the column of water between the surface of the water in the well and the bottom of the piston, for the atmospheric pressure must, in the first place, sustain that column, and can only act upon the bottom of the piston in

the upward direction with that amount of force by which it exceeds the weight of the column of water between the piston and the well. The effect, therefore, on the piston is the same as if it were pressed downwards by the weight of the column of water between the piston and the well, and at the same time pressed upwards by the atmospheric pressure. Thus the piston may, in fact, be regarded as being urged downwards by the following forces:—the atmospheric pressure, the weight of the water above the piston, and the weight of the water between the piston and the well, that is to say, in fact, by the atmospheric pressure, together with the weight of all the water which has been raised from the well. At the same time, it is pressed upwards by the atmospheric pressure transmitted from the surface of the water in the well. This upward pressure will neutralize or destroy the effect of the same atmospheric pressure acting downwards on the surface of the water above the piston, and the effective downward force will be the weight of all the water which is contained in the well, and of all the water which is contained in the pump. By this reasoning, it appears that the pump must be worked with as much force as is equal to the weight of all the water which is in it at any time, and, therefore, that the atmospheric pressure affords no aid to the working power."—*Pneumatics*, chap. vi. p. 317.

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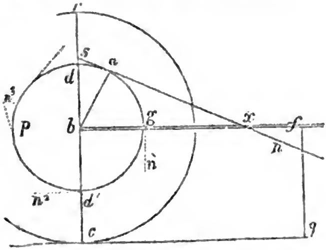
PRINCIPLES OF LOCOMOTION—SAXULA'S THEORY.

Sir,—Allow me to say a few words relative to Saxula's 5th proposition. It appears to me that it is true in those cases only where the power acts *externally*.



Let *rbc* be one of the wheels of a carriage to which the power is applied; *cq*, the plane of motion to which *bf* is parallel. Suppose *agd̀* to be a drum, firmly connected with the wheel *rbc*, and moveable on the same axle *b*, and having a rope coiled round it in the direction *agd̀*. Then the power at one end of the rope *n* may act in every possible direction with respect to *bf*, as at *an*, *gǹ*, *d̀n''*, &c.; and would, provided there were no obstacle at *c*, as friction, cause the wheel to turn in one direction only. But supposing either a cog or friction at *c*, and the power acting externally, various effects take place—in some cases progression, in others retrogression. To determine how this is, let the power be acting in any direction, for instance *an*; it is required to find the tendency of the carriage in the direction *bf*. Here *abc* is a bent lever, whose fulcrum is at *c*; and by mechanics, any force at *a* produces the same effect at *b* as it would do if applied at *s*, the extremity of a straight lever *sbc*, and the force at *s* estimated in the given direction $bf = \pm \text{P} \cos. sxb$, and the force at *s* in the direction *bf*: force at *b* in same direction $= bc : sc$ ∴ the force urging *b* in direction $bf\ (=\text{Q}) = \pm \frac{\text{P} \cos. sxb}{bc} \times sc$, but $sc = bc \pm bs$ and $bs = \frac{ab}{\cos. sxb}$ whence, by substitution, $\text{Q} = \pm \frac{\text{P} \cos. sxb}{bc} \times \left(bc \pm \frac{ab}{\cos. sxb}\right) = \text{P}\frac{ab}{bc} \pm \text{P} \cos. sxb$, a general expression for the force which urges the carriage at *b*, in the direction *bf*, employing the lower signs when the power (estimated parallel to the plane of motion) acts in opposition to that direction, which it does every where between *g* and *r* in the lower semicircle *grd*. Hence the force at *b* in the direction *bf* is equal to the *sum* of the forces acting in that direction at *a* and *e*.

Cor. 1. When *abc* becomes a straight lever, *a* coincides with *d*, and $\cos. \angle sba = sxb = 1$ and $\text{Q} = \text{P}\frac{db}{bc} + 1 = \text{P}\frac{cd}{cb}$.

2. When *a* is at *d̀* $\cos. sxb = 1$, and since the power acts in the opposite direction *fb*, $\text{Q} = \text{P}\frac{bd'}{bc} - 1 = \text{P}\frac{c\grave{d}}{cb}$, and the carriage retrogrades; in the former case it advanced.

3. When *a* is at *g* $\angle sxb = 90°$ and its

cosine $= o$, and $Q = P\frac{ab}{bc}$, and g is, as will afterwards appear, the position where equal external and internal powers produce like effects.

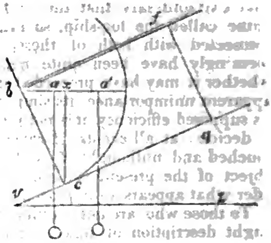
4. When $\frac{ab}{bc} = \cos. sxb$ and P acts in opposition, we have $Q = o$, and no motion at all can ensue; and this angle is evidently that where *an* passes through *c*.

5. Similar effects take place in the other semicircle at equal distances from *d*.

If now we suppose the rope to be coiled round the drum in the reverse direction, and estimate the tendency of the carriage in the direction *fb*, we shall obtain precisely the same solution as above: and the two together will comprise every possible case that can be proposed, by a variation of the length of the crank *ba*.

Next, let the power act in the above direction, [but from within the machine, as by a steam-engine placed at *x*, or any where in the line *ax*, and attached to the perch *bf*. Then, $Q = P\frac{ab}{bc} \pm P \cos.$ *sxb* would, in this case, also be the force urging *b* in the direction were it not for the *re-action* of the power P against *x*, which re-action is, of course, equal to the *action* of the power, but in the opposite direction *xa*. But the re-action acts obliquely against *f*; its force at *x*, estimated in the direction $f = \mp P \cos. sxb$, being *negative* in every case, the power is *positive*, and *vice versa*, and consequently carries different signs. Hence the force at *b*, in this case, is $P\left(\frac{ab}{bc} \pm \cos. sxb \mp \cos. sxb\right) = P\frac{ab}{bc}$, a constant and always *positive* quantity so long as the power tends to force the wheel round in the direction *agd*; whence the following rules for calculating the forces at *b*:—

Imagine the fulcrum to be at *b* in the carriage in both cases. And, first, when the power acts *internally*,—find the force tending to move the abutment at *c*, in the tangential direction. Secondly, when power is *external*,—to the force exerted against the abutment *c*, add that of the power estimated in the direction of motion *bf*.



To apply this to the case in point, let *cp* be an inclined plane, and let the power be *external*, as a weight suspended from *ax*, the horizontal spoke of the wheel. Then the force at *b*, in the direction $bf = P\left(\frac{ab}{bc} - \cos. qcx\right) = P\left(\frac{ab}{bc} - \cos. cbx\right) = P\left(\frac{ab-xb}{bc}\right)$, which quantity is evidently *negative*, and the carriage must go backwards (*i. e.*) in the direction *fb*; but if $ab > xb$, the quantity is *positive*, and the ascent may be accomplished, provided $P\frac{ab-xb}{bc} = P\frac{ax}{bc}$ is greater than the load (= L) × sin. *qvz*.

In case the power is *internal*, we have seen $Q = P\frac{ab}{bc}$ in all cases, and independent of the plane's elevation; consequently, if $P\frac{ab}{bc}$ exceed L sin. $\angle$ *qvz*, the machine will ascend; and since P can be increased without adding to the load, the case is always possible *in theory;* and if so, locomotive-carriages are built upon *principles* demonstrably correct.

In *practice* the angle of the plane's inclination is limited (as Saxula has remarked) by the quality of the friction at *c*.

Yours, &c. R. C. Jun.

AN IMPROVED LOG-SHIP. BY LIEUTENANT THOMAS GRAVES, R.N.

Amidst the various propositions and alterations that have lately been made in the equipment of a ship, among which may be mentioned the improvements in both binnacle and azimuth compasses by Captain Phillips, and the iron plates for counteracting the effects of local attraction by Professor Barlow, it appears rather extraordinary that the useful machine called the log-ship, so intimately connected with both of these, should seemingly have been quite neglected; whether it may have proceeded from its apparent unimportance, its simplicity, or its supposed efficiency, it is not pretended to decide; at all events, it remains untouched and unthought of, and it is the object of the present communication to offer what appears an improvement.

To those who are not nautical men, a slight description of that at present in use may not be unacceptable or uninteresting.

Fig. 1.

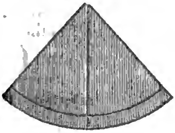
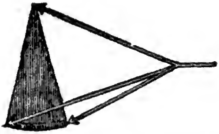


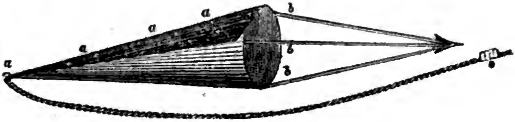
Fig. 2.



The common log-ship (fig. 1) is a flat piece of wood in the shape of a quadrant, loaded with a sufficient quantity of lead, on its circular edge, to make it remain in a perpendicular position on or near the surface of the water; to this is attached the log-line (fig. 2), divided into spaces called knots, the distances between which bear the same proportion to a nautical mile, that twenty-eight seconds do to an hour, and wound round a reel. This being held by one man, and a twenty-eight second glass by another, the log-ship is thrown over the ship's quarter to leeward, and swimming perpendicularly, remains nearly stationary; when the first mark goes out, which is generally about eighteen or twenty fathoms from the log-ship, the glass is turned; and at the time the sand in the glass is run out, the line being stopped, shows by the marks on it the rate at which it is sailing per hour.

The log-ship now proposed is a cone, composed either of tin or thin copper, with the part *aaa* made air-tight, which, in light winds, will prevent its sinking, and also preserve its horizontal position, when thrown overboard near the surface: it is slung at the points *bbb* by lines, much smaller than the standing part uniting at *c*, where a spicket or peg is attached; at the end of the cone *d* the line itself is secured, and on it at *e* is fixed a faucit that receives the peg; the log-ship is then ready for use.

Fig. 3.



The advantages it will have over the old construction are, that when the log-line is stopped, the increased weight of water in the cone causing the peg to come out easily, it instantly turns over, and may be hauled in without any resistance; that it will remain more stationary when thrown overboard; that a following sea, from its shape, will not have so much effect in propelling it after the vessel; that it will not carry away so many log-lines (as in the event of the peg not coming out, one of the small lines to which it is attached must give way); that it will always catch properly, which the one at present in use scarcely ever does; and at the same time the expense will be no consideration; and on board of any of his Majesty's vessels it may be made in as short a time as the old one, by which is obtained the ship's rate of sailing at all times with greater accuracy; and it will prove of essential service in making the land during foggy weather—while the other, from its numerous imperfections, can never be depended upon.

As its construction has been approved of by many naval officers, several of whom have had opportunities of using it—and from repeated trials of my own, it answered all the objects proposed—I feel less diffidence in presenting it to the public.

The valuable invention of Mr. Massey, at Liverpool, is on an entirely different principle, it cannot be too highly recommended; but its expense is a great obstacle to its general introduction, whereas the proposed one is recommended by its simplicity and cheapness.

The log-line, although liable to some error from contraction and expansion, in being alternately wet and dry, becomes tolerably well seasoned with salt water after a little use, so as to render it quite sufficient for the purpose intended; still there is much room for improvement, and perhaps one made from cotton would be less affected by the causes above-mentioned.—*United Service Journal.*

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THE HYDRAULIC MOVER ON THE PRINCIPLE OF BARKER'S MILL. P. 249.

Sir,—Allow me to express my surprise at Hezron's letter, p. 349, in commendation of a Journeyman Mechanic's scheme for an hydraulic mover, p. 249. The errors in the construction of it, I shall, like him, pass over, and at once suppose the thing as perfect as it could be made. Now, in the first place, the syphon is worse than useless, as an extension of the cistern H, would secure the same equilibrium that is procured by the syphon, besides saving the trouble and difficulty of filling, as well as the friction of the water passing through it. 2ndly. The adoption of Barker's principle (as appears by the engraving), has been under the erroneous idea, that, but little fall is requisite. This, without examination, is granted, or taken as such by Hezron; but the case is far otherwise, for, without a considerable head, the water would not be discharged with sufficient velocity to create the reaction from which alone the power of this mill is derived.

Yours, &c. TREBOR VALENTINE.
Derby, August 9, 1831.

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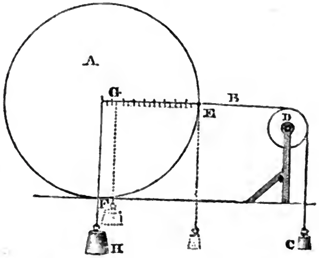
THE LATE PERFORMANCES ON THE LIVERPOOL AND MANCHESTER RAILWAY.

Sir,—It has been said, that 12½lbs. are sufficient to move forward a ton upon a railway. How can this be ascertained? Why, by hanging a string attached to the carriage, with a 12½ lbs. weight to it over a pulley. Yet the opponents of my Theory of Locomotion, deny me weights to represent my power, because I hang them upon the wheels. Now, if 12½lbs. will draw one ton, 1250 lbs. will draw 100 tons—why, then, in your No. 415, page 333, is it considered so great a feat to draw 86 tons? When, perhaps, the two steam pistons of the carriage furnished 200 square inches of surface at 50 lbs. per inch pressure, or a power of 10,000 lbs. (omitting leakage and so forth) which, calculating in the rough, ought to draw 800 tons! Why all this waste of power? My theory will tell you.



Let A represent a pair of steam-carriage wheels, 54 inches diameter, carrying 100 tons, represented by H; B, a rope, fastened to the axle of the wheels, with a weight C of 1250lbs. over a pulley D, just sufficient to draw the 100 tons. Now, my theory says, and experience sanctions it, that the same weight of 1250lbs. hung on the wheels at E, will draw the 100 tons likewise on a level surface; but as there is always some hindrance or fulcrum, however small, at F, the nearer the weight or power is applied to F, the greater it must be; until when the power is applied at G, or only 9 inches from the axle, it will require 3 or 4 tons to do the same that 1250lbs. will do at E, and this by the common proportions of the lever. Thus it is that such an enormous steam power is requisite to move such a comparatively small weight, with short cranks, at a swift pace on the rail-roads. And if this be not a rough proof of the general truth of my theory, I fear I cannot furnish one. Let those who dispute it account for the above-mentioned consumption power in a better way. What says Mr. Baddeley? Will no one take up a cudgel on my side?

> "His praise is lost who stays till all commend."

Yours, &c. SAXULA.

August 4, 1831.

P. S.—An answer to Trebor Valentine shall be forthcoming.

◆

ON THE BURSTING OF WATER-PIPES.

(Selections from Correspondence, concluded from p. 356.)

Sir,—I think facts will warrant a much broader conclusion on the subject of the bursting of water-pipes than is generally supposed. My belief, founded on a good deal of observation, is, that they burst at all times and in all states of the atmosphere—before frost, during frost, and after frost. *Before frost*, either because of some parts of pipes being accidentally weaker than others, or of general excess of pressure. *During frost*, in consequence of the expansion of the water in freezing. And *after frost*, through the elastic force of air-bubbles remaining in the ice—which is evidently quite a different case of eruption, from that arising from the increased bulk of water in its solid state. I have frequently heard the notion of pipes bursting after frost ridiculed as a vulgar error, originating in the circumstance that it is not till after the ice becomes fluid that the rupture becomes apparent. But does not ice itself frequently burst from the escape of the air contained in it (in the process of thawing, of course)? And if so, why may not a pipe containing it, be also burst by that identical air? The explosion, for example, of ice in open ponds and reservoirs, where there is nothing to obstruct mere increase of bulk, is a common occurrence; and this breaking up I have generally observed to be contemporaneous with a rise of temperature.

Yours, &c. I. S.

Stratford-on-Avon, July 15, 1831.

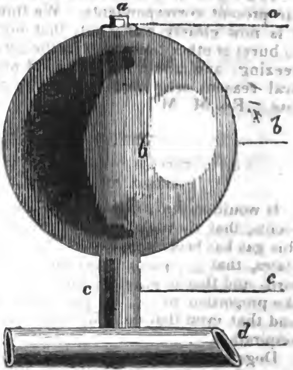
Sir,—Some of the observations and recommendations of Mr. William Baddeley (page 339) "on the bursting of pipes by frost," are both sound and useful; but he has not given satisfactory reasons for certain effects. I have had frequent opportunities of observing minutely, water when first assuming a state of congelation in large vials during winter, as well as the process of thawing; and I beg to hand you the following remarks, founded upon such observation.

If an 8 oz. (½-pint) vial, be filled to the shoulder with water, left uncorked, and allowed to freeze naturally in winter, which is the best means of obtaining correct results, it will be perceived that the process begins by the water crystallizing (a bad term) in right lines, always emanating from the sides, and generally beginning at the top. The surface of the water being more exposed to the cold air than the centre, first becomes solid by the ramifications intersecting each other. The process goes on through the whole body in the same manner, and I conclude, that the air contained in the water is wholly disengaged, and driven into globules of various sizes, which are always to be seen. Bottles filled to the shoulder frequently break, although uncorked; and, in like manner, pump-barrels and pipes burst by frost, though the action of the valves is favourable to the escape of the air or water. I therefore conjecture, that the surface now becoming solid, and the air being driven into globules as before observed, receives a considerable portion of the caloric, which causes its expansion, and the consequent bursting of the pipe or vessel. Such will always be the effect, if the process of congelation proceeds rapidly, for, in such cases, the water does not give out its caloric sufficiently quick to the external air, but escapes with the confined air into globules. In confirmation of this, if an iron rod, heated, be passed through the top of the ice in the bottle, before it becomes a mass, the air will escape, and for a certainty no bursting will take place. Again, in the process of boiling of water, the minute particles of air pervading the whole, are rapidly expanded, and, consequently, rise from their extreme lightness, and burst on the surface. Farther, if you fill a vessel having a narrow mouth, with cold water to the brim, and place it in a pretty warm situation, it will be seen, that a considerable quantity will run out of the mouth, which arises from the expansion, not of the water but of the air it contains.

If 2 vials are each half filled with water, and one corked, that which is uncorked will begin to freeze at the usual temperature, but the other will remain unchanged, if kept perfectly still for some hours, exposed to even 8 or 10 degrees lower temperature; but remove the cork, and gently agitate it, and a solid mass will be quickly formed. This appears to be caused by the external air being allowed to assimilate with the hitherto confined air, and the rapid disengagement of caloric from the fluid, by the agitation. It does not appear, as De Mairan supposed, that "freezing points or laminæ have a tendency or preference to unite by certain sides," for it is well known, that pieces of ice will readily unite, in whatever way they are presented to each other, if connected by water, and therefore there cannot be a preference. A solid state is produced, by the promiscuous intersection of numerous ramified parts.

In opposition to the positive assertion of Mr. William Baddeley and Mr. William Green, &c., to the contrary, I think it can be satisfactory proved, that vessels occasionally burst during the process of thawing of fluids contained in them; in fact, I have seen it occur with glass vials, and I account for it in this way:—Where air has accumulated near the sides of vessels during the process of freezing, and the whole becomes of one temperature, it is evident, that the globules of air must receive the first impression of a change in the atmosphere, and its consequent expansion burst the vessel, provided the surface remains unchanged, which will depend upon the nature of the vessel and its situation.

From the foregoing remarks, I cannot discover any effectual means for the prevention of pipes, &c., bursting, when containing water; but I should be glad to have the following suggestion for such purpose, taken into consideration by some of your able mechanical correspondents. Connect to the most exposed part of a leaden, or any other pipe containing water, by a neck, 3 or four inches long, of the same material, a hollow copper ball of 6 or 7 inches diameter, having at its top a pretty firm safety valve, and placed as regards the pipe in an upright position, in the manner described in the following sketch:



a, is the situation of the valve—*b*, the copper-ball—*c*, the connecting neck—*d*, the main pipe. The points to ascertain are: 1st. will the compressed air, occasioned by the freezing-process, escape to the ball, and prevent bursting by removing pressure from expansion?—2dly. would the water at any period, in the pipe, take possession of the ball?

Yours, &c. G. L. S.

Enfield, Aug. 4, 1831.

[The letters with which we now conclude our selections from this interesting correspondence, render it unnecessary that we should make all the remarks we had it in contemplation to offer on the subject. We do not subscribe to every thing in these letters, and must particularly except the supposition of I. S., that the bursting of ice only takes place contemporaneously with a rise of temperature, which is not, we believe, true, in the sense our correspondent uses the expressions; the fact being, that the lower the thermometer falls, the greater is the chance of such explosions—the ice, at every degree lower of the scale, parting with more and more of its heat to the bubbles of air formed in it, and the elastic force of these bubbles increasing in proportion as *their* temperature is *exclusively* increased. But, in as far as respects the particular question under investigation—namely, the cause of the bursting of water-pipes after frost—our views are generally the same as those of our present correspondents. We think it is now clearly made out, that pipes do burst at other times than in the act of freezing, and that there are good physical reasons why such should be the case.—ED. M. M.]

DELETERIOUS EFFECTS OF SULPHURETTED HYDROGEN.

It would appear, from various experiments, that the deleterious tendency of this gas has been overrated. Dupuytren states, that $\frac{1}{800}$ part of this air killed a bird, and that it was necessary to reduce the proportion to $\frac{1}{1000}$ to prevent death, and that even that quantity embarrassed respiration.

Dogs were killed by one part in 299 of atmospheric air; and according to Chaussier, $\frac{1}{250}$ will kill the strongest horse. At this rate, $\frac{1}{365}$ ought to be sufficient to take the life of a man; but in cleansing the sewers in Paris, it has been found by accurate observation, that the men could work without inconvenience in an atmosphere containing one part of sulphuretted hydrogen in 100 of common air, and that they constantly breathed from 25 to 90 thousandths of this gas.

A dog, of middle size, was thrown into the Amelot sewer, where he remained more than a week, accompanying the men when at work in cleaning it, and frequently scratching the mud; and it was proved that the air of the sewer, at this time, must have contained at least 1 per cent. of sulphuretted hydrogen. The analysis of able chemists has shown that the quantity of this gas which is constantly found in sewers, exceeds the proportion which, in the experiments of Dupuytren, produced asphyxia in animals of a medium size. A case is cited in confirmation of this conclusion. A cat having been shut up in a laboratory several days without food, became so furious that it was found necessary to destroy her. For this purpose a vial containing sulphuret of antimony and muriatic acid was fastened to a stick, and the opening held to the cat's mouth. In this manner she breathed an enormous quantity of the gas, and though convulsed by it so as to occasion her to spring up and rebound violently, they were unable to kill the animal, until by scattering the antimonial powder around her and sprinkling it with the acid, she was surrounded with an atmosphere of the gas. This destroyed her in about 12 or 14 minutes. It would therefore be rendering a service to science and humanity to examine anew the real action of sulphuretted hydrogen, breathed in variable proportions.—*Ann. D'Hygiène.*

"COMMERCIAL SCIENCE."

Sir,—The density or maximum weight of water, is a consideration of primary importance to the calculation of colonial and foreign exchanges.

With every respect for the learned author of the *Cambist*, Dr. Kelly, I beg leave to reassert that the English, Spaniards, and Portuguese, throughout the world, have the same standard of weight, which is *arbitrarily* in the relation to the Chinese standard, as 4:3.

2 English *foot* cubic = - - - 3,456 inches cubed.
1 Fanega, the Spanish *standard* of capacity,
is accounted by Dr. Kelly, (2nd Ed.)= 3,439

The Cambist is in error - 17

Dr. Kelly then proceeds to state, (2nd Ed.) that 100 pounds Spanish = 101·44 English."

This pound (avoir-du-pois) was sent from Spain to England, by Charles V. And hence, the Commercial Treaty which exists.

In the opinion of M. Lefevre Gatineau, water has, in every latitude its maximum weight at 4° centigrade. M. Gatineau does not inform us how often his water should be distilled. Rain, as it descends from heaven, is, no doubt, on earth, purer than the waters of the Tagus or the Ebro, while it is of more uniform density than the double distilled water in the unnatural metrical measure. This is the practical opinion of the world, though the Spaniards fill the Fanega with running river water. "Agna de rio corriente."

In every latitude, the maximum weight of
rain water and alcohol, is as - - 5:4
So is the centrigrade - - - 100:80
Fahrenheit is wrong - - - 212:174.

Dr. Kelly says, with the Spaniards, that 4 arrobas = 1 quintal. But as we are on the eve of entering into Commercial Treaties with the Chinese, numerical words must be estimated by their real values : 4 arrobas=1 *quantal.*

2 English *foot* cubed of rain water = - 2,000 ounces.
$\frac{1}{5}$ 400
100 pounds of alcohol - - - 1,600

The Egyptian quintal of 100 rotolos = - 2000 ounces.

Liquids are sold by weight in the Oriental countries, and the coins are *proof* weight.

1 Bazar seer = - 32 ounces
1 Liquid chatack $\frac{1}{16}$= - 2 „ = - 5 *standard* rupees.
The original Portuguese quintal was, as the
Galician is, 5 arrobas = - - 2,000 ounces.
4
The Goa candy is - - - - 8,000

Not 7,920 as the *Cambist* has been informed.
The East India and Birmah candy, is
also 500 pounds English, Spanish, and
Portuguese. Consequently, 5 *quintals*, or
4 quintals } =1 candy.

In the 1st Ed. of the Cambist, the Chinese
pecul is accounted - - - 132 lbs., 8 oz., 9 drs.
In the 2nd Ed. - - - - 133½
Of course, 3 Chinese ounces = - 4 English, Spanish, and Portuguese.
1,000 : 833⅓ : : 720 cash : 600 = - 6 shillings.

Mr. Thornely, the eminent Liverpool merchant, Mr. Bates, of the firm of Messrs. Baring Brothers, and Co., and other eminent merchants have *proved* in evidence to the Parliamentary Committees on East India Affairs, that the *par* of exchange between Asia and America, is 720 cash for the dollar, as I have repeatedly stated in the Mechanics' Magazine.

The weights and measures of European Spain are so confused, that by the 19th and 20th articles of the constitution of the Cortes, it was proposed to adopt the most exact and convenient system, with reference to the value and denomination of money. If the weights and measures be wrong, the finance accounts must also be wrong: for, as the labourer wields the weights and measures physically, so must the accountant figuratively. *It is not, however, European, but American Spain, whose dollars regulate the monetary exchanges of the world.*

Considering the legitimate object of every branch of science to be the happiness of nations, in preference to the monopoly of wealth by individuals; no human being, whom the Almighty has blessed with reason, not merely to protect himself from, but to subjugate the most ferocious beasts, can, for one moment, suppose that, exchanging with the remainder of the world, the *big* ounce Troy, for the *little* ounce Spanish, is " the Science of Political Economy."

There is much truth in the American distich,

> " You give us 12 for x—yet, how very strange.
> You cannot balance your *economical* x'change."

Yours, &c. T.

August 6.

MODE OF PREPARING CHLORIDE OF LIME.

Sir,—I think if you would give insertion in your valuable Journal to the short extract subjoined from a paper of Professor Becks, on the manner in which the chlorides of soda, lime, &c., are obtained, and their mode of operation as disenfecting agents, you would greatly enhance the favour you have conferred on your readers, by the seasonable article in your 416th Number, on the "Prevention of Contagion."

Yours, &c. CHEMICUS.

Preparation.

"There is nothing peculiar in the preparation of the compounds under consideration. All that is necessary is, to subject the hydrates or solutions of potassa, soda, lime, and, indeed of any of the fixed alkalies or earths, to the action of a current of chlorine gas. If, instead of these, we pass a stream of the gas through solutions of the carbonated alkalies, equally efficient compounds are produced; and we shall, hereafter, see that other salts may also be employed for the same purpose."

"The substance which has received the name of *Labarraque's disinfecting liquid*, is prepared according to his own formula, as follows:—2800 grains of chrystallized carbonate of soda are dissolved in 1·28 pints of water; the solution being put into a glass, there is then passed into it two thirds of the chlorine, evolved from a mixture of 967 grains of salt, with 750 grains of oxide of manganese, when acted upon by 967 grains of oil of vitriol, previously diluted with 750 grains of water.

"This liquid may also be obtained in the manner proposed by M. Payen, which consists in the mutual decomposition of chloride of lime and carbonate of soda. But this method will seldom be employed as all the valuable purposes of the article can be obtained by the use of the compound of chlorine and lime alone. This is now so extensively employed in the process of bleaching, that there is little difficulty in obtaining it at any time; when it cannot be procured, however, solutions of lime or soda may be easily changed with chlorine gas in the following manner. Into a Florence flask introduce manganese, common salt, and diluted sulphuric acid, in the proportions above-mentioned—taking care that it is not more than a third filled. A bottle containing lime-water, or solution of soda, or its carbonate, is to be kept at a temperature of 60° F. or below. Adjust to the mouth of the flask a bent tube, one leg passing to the bottom of the bottle containing the solution; the heat of a lamp, or of a few coals must be then applied to the flask. By this means chlorine is evolved, and is absorbed by the solution. The heat must be continued till the evolution of chlorine has nearly ceased, which will generally be from fifteen to twenty minutes. The clear fluid is now to be decanted. It is the disinfecting liquor.

This disinfecting compound may, therefore, be obtained in either of the three following ways—

1. By dissolving in water the common bleaching-powder, usually denominated chloride of lime.
2. By passing a stream of chlorine gas through solutions of lime, soda, &c.
3. By passing a stream of chlorine through a solution of carbonate of soda, or by adding chloride of lime to dissolved carbonate of soda.

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NOTES WORTH NOTICE.

"'Money,' said the great BACON, 'like manure, is of no use unless it be spread;'—the same may be said of knowledge."

The Lord Chancellor "Abroad."—An Italian translation of Lord Brougham's celebrated "Discourse on the Objects, Pleasures, and Advantages of Science," has been published in the course of the present year at Turin, by the bookseller Pomba, who is engaged in the publication of a periodical work on the plan of our Family Library, &c. called "The Universal Library of General Instruction," of which his Lordship's excellent treatise forms a part.

Civilization in Africa.—The American negro colony of Liberia continues in a most flourishing state. Only eight years have elapsed since Cape Messurado, then a mart for the sale of 10,000 slaves annually, was purchased from the natives: in that short period, that unhallowed traffic has been entirely destroyed; a flourishing colony of 2000 emancipated slaves has been founded; churches, schools, commerce, and even *a newspaper* established, and 10,000 of the aborigines reclaimed from savage life. The latest intelligence from the colony is of the date of February 21, 1831, and is contained in a letter from the Governor, according to which the recent improvements in commerce, agriculture, buildings, &c., have been astonishingly great. In one town (Monrovia) alone upwards of twenty-five substantial stone and frame dwelling-houses had been erected within the last five months: more business is done at this place than at any of the European settlements on the Gold Coast; and the great increase of commerce was evident from the swelling of the "marine list" in the *Herald* newspaper. A Company had been formed, the "St. Paul's River Navigation Company," but had as yet done nothing; and so far, and fast, had civilization advanced, that taxes had made their way into the infant state, in the shape of an impost of 50 cents. per 100 dollars on real property—to be appropriated, however, solely to the use of the public schools! Heavy duties are also levied on spirituous liquors, which go to the same object. A place of worship is established, with Sunday schools attached, and the morals of the people—aborigines, American negroes, and recaptured slaves—altogether are "much better than those of the people of the United States! The Sabbath is very strictly observed; and breaches of the peace are so rare, that the Governor has only had to adjudicate on *one* since his arrival! It would be unfair to conclude without observing, that an agent of the American Colonization Society is now in London, and ready to receive the subscriptions of English admirers of the plan. We only hope the above statements are not too highly coloured.

Civilization in India.—An Agricultural and Horticultural Society has been for some years established at Calcutta, whose objects are—"to overthrow a blind routine founded on the ignorance of the Indians, and their division into castles; to show them that they can cultivate otherwise than they have done during 2000 or 3000 years; to engage the principal among them to occupy themselves with agriculture, which they despise—to introduce more perfect agricultural instruments, and species and varieties of useful plants, with which they are unacquainted." The first volume of the Society's transactions has just been published, from which it appears that the number of members on July 1, 1828, was ninety-seven, mostly Europeans, but with a mixture of natives, as is testified by the euphonious names of two of them, Prusunnukoomur Thakoor, and Ubhuyachurun Bariojya. But little progress has as yet been made against the long-grown prejudices of the Hindoos, although there is much room for hope as to the future. Agriculture in Hindostan has received a considerable impulse from the establishment of a Botanic Garden at Calcutta, which was supported for many years by the East India Company at an annual expense of 5000*l*. This sum has been reduced; but it is expected, that when the affairs of India, now in suspense, are settled, not only Botany, but other sciences, Mineralogy, Geology, Zoology, &c., will be munificiently encouraged.

Scientific Meeting at York.—This meeting, on which some observations have already appeared in the Mechanics' Magazine (No. 403, page 144, and No. 404, page 155) is appointed to be held on Monday, 26th September, at the York Museum. The idea, it appears, originated with Dr. Brewster, and the meeting is to be held in a different town each year. We anticipate a grievous failure.

Disappearance of the New River.—If we can trust to rumour, this paradise of cockney anglers is about to be filled up from the "Head" at Islington to Hornsey, and its place for that distance, supplied by iron pipes! It is added, that the company expect to be reimbursed for the outlay by realizing the value of the land which the river, with its banks, now occupies. The change, though for the better in some respects, would be generally regretted on the whole.

Buckingham's Voyage round the Globe.—Mr. Buckingham is now again on a provincial tour through England, lecturing as he goes on the East India Monopoly. In an address lately to the people of Sheffield, which town he wishes to represent under the New Reform Bill, Mr. B. stated, that, "on account of the public mind having been fixed, soon after the promulgation of his scheme, on the Revolutions in France, Belgium, and Poland, and afterwards on the great question of reform," he has abandoned his intention *for the present*—the public evincing no desire to find the means of prosecuting it. How does this tally with the statement which he made in Paris, in order to excite the French to emulation, that "the scheme was so popular, that it has become a *National* one in England?" We suppose the notion has been given up altogether—and if so, what has become of the subscriptions?

F. H.

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INTERIM NOTICES.

Communications received from A Woolwich Cadet—L. M.—S. H.—J. L.—Mr. P. Harrison—A Querist—Mr. Baddeley—C. W.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-Office-court, Fleet Street.

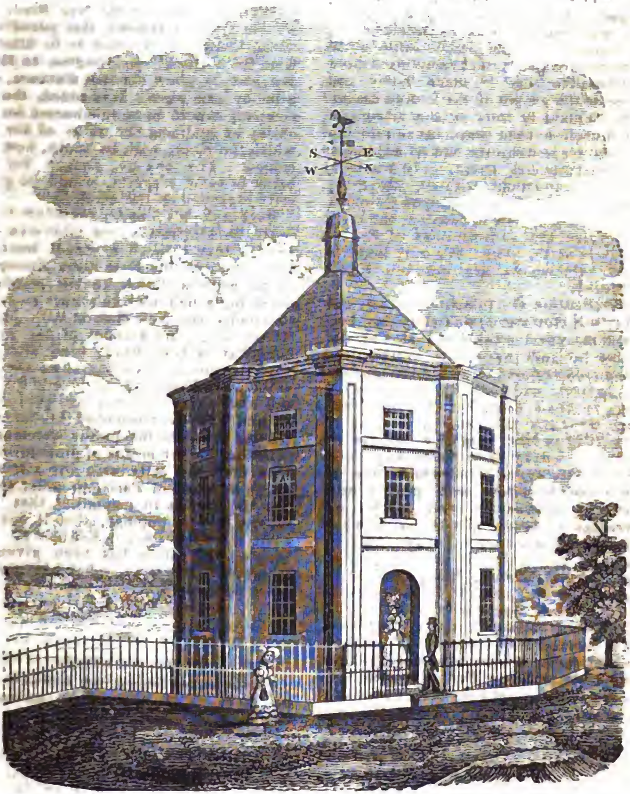
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 419.] SATURDAY, AUGUST 20, 1831. [Price 3d.

NOTTINGTON SPA-HOUSE, NEAR WEYMOUTH.



NOTTINGTON SPA, NEAR WEYMOUTH.

Sir,—Presuming that the pages of your highly esteemed and widely-circulating publication, the Mechanics' Magazine, are open as a medium of communication to the public on matters of chemical as well as mechanical science, I send you an account of a medicinal well in this neighbourhood, the properties of which have of late attracted a good deal of attention.

In the delightful and picturesque little vill of Nottington, which lies about three miles north of Weymouth, on the left of the road, leading from that place to Dorchester, is the mineral spring I allude to. It is now surrounded by an elegant and tasteful structure, called Nottington Spa-House, a sketch of which accompanies this communication. Just previous to entering the village of Broadway, a road branches off to the left, which leads to the Spa-House, and, through the vill, passes to the adjoining villages. The mineral spring rises on the margin of the River Wey, close by the side of the public road. The River Wey itself originally appears only about two miles distant north of this spot, in the romantic village of Upwey, distinguishing *it* as its birth-place—the Up, (a Saxon word) or rise of the Wey—and meandering through the meadows, glides by and through the villages of Broadway, Nottington, and Radipole, then falling into the sea, gives name to Wey-mouth.

A mineral spring has existed in Nottington for a period beyond tradition; or, in other words, "time out of mind;" and considerably more than a century ago, its curative properties had been ascertained, as we find the celebrated chemist of those days, Godfrey, analysed the water in the year 1719, and communicated the result to the Royal Society. Prior to this, its healing qualities were accidentally established by an occurrence somewhat similar to that to which the waters at Bath are indebted for their notoriety. A shepherd was driving a flock of sheep through the village of Nottington, many of which were suffering under a disease to which sheep are very subject, termed the *scab*. As he passed the spring, which was contiguous to the road, and open, as springs in those days generally were, on all sides, several of the sheep drank of the water, and, as it formed a small lake or pool, walking through it, washed themselves. Such of the flock as did so, gradually recovered and became sound. This was attributed, and justly so, to the virtues of this water. Doubtless, antecedent to this occurrence the efficacy of it was partially known in its immediate vicinity, though limited as to general use *medicinally*. The spring was (from traditional authority) the parochial or village spring, to which every one had access in common. The circumstance above-mentioned was matter of public notoriety, and afforded much gossip at the time. The water was occasionally applied by the common people in the neighbourhood in cases of eruptions of the skin, and in rheumatic affections, with universal success. In more modern times it has been used with great efficacy in chronic gout, nervous affections, and complaints arising from obstructed or morbid secretions, (as indigestion, jaundice, &c.) or from extreme states of debility. It invigorates and gives tone to the system, acting as a most powerful restorative. As an alterative, too, contrasted with mercury, it deserves a decided preference in the opinion of the more eminent of the faculty. Much more might be truly said, but it would seemingly savour of quackery, which would be as unbecoming as it is unnecessary.

This medicinal water, owing to a want of accommodation, has not, till of late, been so much resorted to as it deserved; nor would it have acquired the celebrity which it now maintains, but for the spirited exertions and liberality of Mr. Thomas Shore, the present proprietor. The ancient spring before-mentioned was, some years ago, with a view to rendering it a source of profit, inclosed after the manner of a well, with the additional security of a lock and key; and the public were thus deprived of the use of it, except on the condition of making a pecuniary remuneration to the presumed owner. Not only was this a violation of a prescriptive right, but it materially limited the use of the water, and restricted the knowledge of its valuable qualities.

Near two years ago, Mr. Thomas Shore, of Nottington, had directed the bank of the River Wey, near his residence, to be repaired. In the progress of the work, and within a few feet north of the original spring, between it and the river, the workmen accidentally discovered another spring. On examining the water, Mr. S. found it possessed of properties dissimilar to common spring water; and, as far as he could judge, very like that in the adjoining well. However, not relying too sanguinely on his own opinion, he transmitted a sufficient quantity to Alexander Barry, Esq. F. L. S. and Professor of Chemistry and Natural Philosophy in Guy's Hospital, London, who analysed it, and ascertained its properties to be as follows:—"Sulphuric, carbonic, and muriatic acid, in considerable quantities; lime a full proportion; magnesia more than usually found; sulphuretted hydrogen in very considerable quantity; oxide of iron, scarcely a trace." On such authority, Mr. Shore, with a promptitude which reflects on him the highest credit, determined to erect a range of buildings, which might afford the public a proper and convenient opportunity of participating in the full benefit of so valuable an acquisition.

He accordingly built the Octangular Spa-House, as represented in the engraving, over the spring. This structure evinces much taste, blending the *utile et dulce* most conspicuously—combining with an elegant and spacious pump-room (in which are periodical works and newspapers for the amusement of visitors) warm, cold, vapour, and shower marble baths, with appropriate and suitably-connected apartments, sitting, and bed-rooms for invalids, open to the public on exceedingly moderate terms, &c. &c. The public appear properly to appreciate the boon, thus liberally offered, by a constant resort to the waters.

Such is the origin of Nottington Spa-House, and if it meet with the success and support which it deserves—and there is no question but it will—the benefit accruing to the public will be much more than commensurate with any profit that can possibly follow to the owner.

It is worthy of remark, that the old well is of late quite exhausted and become useless. Mr. Shore, for his own further satisfaction, as well as to entitle the water of his spring to the confidence of the public, in reference to its peculiar qualities, has again submitted it to Mr. Barry for analyzation, who has lately, *on the spot*, completed another analysis of it, which has furnished the following results:—

Analysis of One Gallon of Nottington Water.

Specific Gravity at 54° Fahrenheit, 1·0013.

Solid Contents.

	Grains.
Carbonate of lime	8·25·
Carbonate of magnesia	5·00·
Sulphate of lime	2·45·
Sulphate of soda	2·75·
Muriate of soda	3·69·
Muriate of lime	3·44·
Muriate of magnesia	3·75·
Alumine	5·00·
Silex	0·05·
Oxide of iron	0·07·
Organised matter	0·05·
Total	34·50·

Gases.

	Cub. in.
Sulphuretted hydrogen	10·
Carbonic acid	7·
Nitrogen	1·
	18·

It is not a little remarkable, and would add materially to confirm (if this were needed) the valuable properties of this spring, that on a comparison with the analysis, which the learned Dr. Graves made in the year 1792, of the water in the adjacent well, the result is such, as to satisfy the most fastidious that the quality of each, so strongly assimilates, as to place it beyond a doubt that the water is one and the same, springing from the same identical source. The learned physician just named, published in the year 1792, *an Experimental In-*

quiry into the constituent principles of the Sulphurous Water at Nottington, near Weymouth; together with Observations relative to its application in the cure of diseases. Many other eminent and scientific individuals have occasionally written on the properties of this mineral water, and several have analysed it. A list of them is subjoined; I admit it is imperfect, but perhaps the publication of this statement, may elicit the names of others equally celebrated, as well as additional information connected with the water for the better information of the public.

It may seem equally a matter of surprise and regret, that with so many concurring testimonies, such strong and forcible recommendations, this valuable water should have been, comparatively speaking, but little known and still less used; but the surprise will cease (although the regret must remain) when it is recollected, that it has arisen solely from a want of decent accommodation for those who have had a desire to use it. Till within the last few months, the water has been certainly but partially known, and sparingly administered to the public.

The arrangements adopted by Mr. Shore at the Spa House, for using the water, as well for bathing as drinking, are equally liberal and convenient. Invalids will find every attention and comfort, and convalescents will experience every pleasure which rural scenery, added to the gratification of inhaling an invigorating beverage, can afford.

What I have here stated, arises solely from a desire that the public, frequenting Weymouth, may know what a desirable acquisition is within their reach. Those who visit this fashionable watering-place for the sake of the gaieties and amusements incident to such a favourite resort of *haut ton*, may thus preserve their health; and those who visit it to court and recall the fickle goddess, may effectually do so, by having recourse to this renovating fountain of Hygeia.

Yours, &c.

VIATOR.

Names of Professional and other eminent individuals who have treated of, and analyzed Nottington Water.

The celebrated chemist Godfrey analyzed it in the year	1719
W. Cumming, M D., treated on it	1740
— Rutty, of Dublin, M.D., analysed it	1749
J. Crane, M.D., analyzed and treated on it	1790
R. Graves, M.D., ditto	1792
I. D. Pickford, M.D., ditto	1816
Alexander Barry, Esq., F.L.S., and Professor of Chemistry and Natural Philosophy in Guy's Hospital, London, analyzed it	1831

Weymouth, July 29, 1831.

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THE LONDON BRIDGE APPROACH FROM TOOLEY-STREET.

Mr. J. Tidmarsh, of East-place, Lambeth, has sent us a copy of a letter which he sent to the New London Bridge Committee on the 5th of April last, remonstrating against the difficulty of the lateral line of approach from Tooley-street to the bridge; and he has also reminded us, that as far back as the 18th of September of last year, when this approach was then but in the course of formation, he pointed out that difficulty in a letter which appeared in No. 374 of the Mechanics' Magazine.

We think there is much force in Mr. Tidmarsh's statements, and must at once allow that, in the case of Tooley-street, there has been a great departure from the rule of convenience so generally followed in the new approaches. The rise of this road from the engine-house, in Tooley-street, to the point of junction with the main approach to the bridge, is about 1 in 20—an ascent as severe as that of Fish-street-hill—and then, after turning into the main road, there is the farther ascent to the crown of the bridge, which, slight though it be, will be found no easy matter to a horse, already tired by the previous hard pull. Mr. T. asks, with some significancy, whether this be "not very like transferring Fish-street-hill in the City, to Tooley-street in the Borough?"—"I have consulted," he says in his letter to the Bridge Committee, "able and experienced carters, who all agree that if they had to convey a heavy load up a hill 200 yards long, that rose 18 or 20 feet higher than the starting-place, if they could go any other way that was as good a road double the distance or more, to come at the same spot, they would prefer the farther way and so ease the horses and save strength—it being so much more gradual. It is also their opinion, that a load of 5 tons (waggon included, which reduces the weight of goods to about 3½ tons) will not be conveyed up such a hill with less than 5 horses, unless they are uncommon good ones; and that, in frosty and slippery weather, such a load will not be got up with that power at all." Mr. T. informs us, that the difficulty of this approach has been even already found out by the carters who have to convey heavy goods. "On Saturday last (Aug. 13)" he says, "I stood for half an hour to see what took place, and I counted that 16 loaded carts and waggons preferred going over the Old Bridge from Tooley-street, while only 7 took the road over the New, and some, no doubt, for the mere novelty's sake." Mr. T. has suggested to the Bridge Committee, that were a road made leading from the Old Ship Inn in Tooley-street, round by the burial-ground of St. Olave's Church, into High-street, Borough, close by St. Thomas's Hospital, this,—though a much longer line of approach to the New Bridge from Rotherhithe—would be generally preferred by heavily laden carriages.

Mr. Tidmarsh is the same individual who first advocated, through the medium of the Mechanics' Magazine, that increase in the width of the New Bridge, which has given such general satisfaction.

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THE PRINCIPLES OF LOCOMOTION.

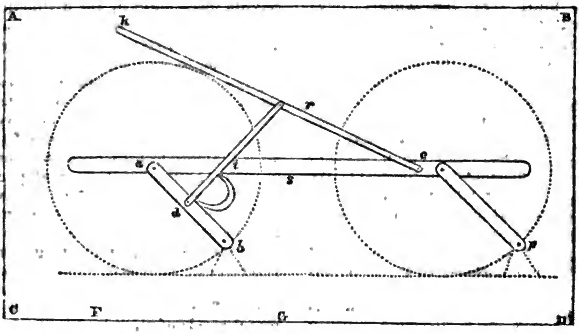
Sir,—I have delayed a reply to Saxula's communication, in No. 410, partly because there is little in it which requires an answer, and partly because there is a kind of an appeal to Hezron, for his assistance in solving the difficulties that I had placed before him; and I was willing to see if Hezron would respond to that call. I have only to notice more at large, one or two points which were merely hinted at in my last communication, and this will embrace all that it will be necessary to say in answer to Saxula's observations.

The case that I proposed and illustrated with a diagram in No. 403, page 135, has proved, as I thought it would, a complete puzzle to Saxula. It is in direct opposition to his "theory," and, therefore, he thinks that "it involves a contradiction." It is at least, he says, "past his comprehension." I proceed to show, that it is neither one nor the other, and to give him the key to all the difficulties presented to him in that diagram. This will also disclose to him the fallacy on which he has founded his theory.

The force of gravitation has been chosen by Saxula, as the representation of the various kinds of locomotive power. I took his own exemplar of those powers, and showed, by the diagram in question, that the efficiency of even this kind of force does not depend on its line of direction being in any particular position relative to the obstacle to be surmounted, but that it depends on circumstances which he had overlooked, and which I did not explain in my last communication. Gravity acts only in a downward direction, but the required effect is an *ascending* as well as a forward motion. Now the circumstances of the case are such, that the weight or gravitating force, has no other point to act on in order to produce this effect, than the machine which is to be lifted. If it did not constitute the actuating force, it would itself have to be raised along with it. It is clear, therefore, that in the same time, it must fall a greater distance than the point of its suspension is raised; or rather, than it would be raised, if the machine were otherwise acted on. To imagine otherwise, would be to expect that the weight should ascend in the air of its own accord, and produce the ascent of other bodies besides. However powerful the weight may be in respect to the carriage, it is impossible that it can raise it over an obstacle, unless it has not merely a relative motion downwards that is, in respect to the machine; but an absolute one, that is, in respect to the earth, wherein only its force exists. Let Saxula draw the diagram in the position represented at page 135, that is, with the wheels on the ground; let him repeat it in a few intermediate positions, until *both* the wheels have ascended perpendicularly over their respective obstacles; he will then find, that the point *k* of the lever *kc*, has described, in respect to the *earth*, a curve *downwards* towards the right hand; but that the point from which the weight *o* is suspended, has traced a curve *upwards* in the same direction. These curves are independent of the respective portions of circles which the points describe in respect to the machine from their common centre *c*. It is unnecessary to tell Saxula, that a weight suspended from the latter point cannot produce *ascending* locomotive effect. It would have to produce motion, as its *point of action*, in a direction directly contrary to that, in which alone, it necessarily moves. Such also would be the case, if it were suspended from any other point of the machine, if under similar circumstances. Thus Saxula has placed his weight on a short crank behind the obstacle to be surmounted; and because in the given situation it is utterly incapable of producing ascending locomotion, and because it has a particular position relative to a supposed fulcrum on the ground, he infers, not only that every weight acting *ultimately* on this point must be inefficient, but also every other kind of force or pressure. We see here the fallacy of drawing a too general conclusion, from a particular and limited case; for I have shown by the diagram in question, that it may be so contrived, that a weight (*m*) acting ultimately on this point (*d*) *shall* produce ascending locomotion, though the same weight, or any other, however great, will have no effect if acting *directly* at that point; proving, that the necessity of the line of force falling behind the obstacle to be surmounted, is a mere conceit of Saxula's; and that the inefficiency, in this position, and thus applied, of the particular kind of force which he has selected as an exemplar of all other forces, is owing to circumstances of which he seems not to have had any perception.

But probably Saxula will require more proof, as to the practicability of locomotion being produced in the way pointed out. He says, "that the point *d*, of the lever *a b*, cannot come *upward* and go *downward*, the same extent, by the *same force*, at the *same time*." Here Saxula loses sight of the distinction between absolute and relative motion. Indeed he is not very fond of distinctions, and is apt to call them "*verbal*." The point *d* is moved upward as it respects the earth, but downward as it respects the machine. In regard, however, to the correct theory of locomotion, I can do little more at present than refer him to the diagram that I gave at page 30, No. 396, and to the observations which accompany it. The controversy mainly rests on this point, whether the fulcrum is on the machine, or on the ground? I perceive, by your last number, that one of your correspondents, "Trebor Valentine," agrees with me in asserting, that the axle of the wheel is the fulcrum on which the crank acts, to produce rotary motion; but he has omitted to say, whether this is amongst the locomotive knowledge which he acknowledges that he has gained from the pages of the Mechanics' Magazine. I have stated elsewhere, that on this point, or rather its analogous one—the rowing of a boat, all the authorities are against me. I can now, by implification, adduce one authority in my favour. It is Emmerson. I give the passage, isolated as I found it, in the Mechanics' Magazine, vol. 10, page 195, for I have not his principles of Mechanics to refer to. "If any machine is to be moved by the help of levers, wheels, &c., and if the power that moves it, acts within the machine, and exerts its force against some external object, then the force applied within, to move the machine, will be just the same as if the machine was at rest, and the object was to be moved—supposing the object to be as easily moved as the machine."

Now, Saxula will admit, indeed he has admitted, that if the machine is at rest and the object is to be moved, the fulcrum is on the machine. But Emmerson says, that the case is just the same when the machine is moved, if the power that moves it be within, ergo, &c. If Saxula can once be brought to understand, that the fulcrum is on the axle of the wheel, he will no longer perceive that there is any difficulty in producing a progressive ascending motion, either by the weight *m*, or the spring at *d*. In order, however, to assist him to decide this point by experiment, in which he appears to have been very unsuccessful, I will describe a method by which he may easily accomplish it.



ABCD is a piece of board to be laid on a table; *ab*, *ac*, and *cp*, are thin slips of wood, to be pinned loosely to each other at *a* and *c*, and firmly to the piece of board at *b* and *p*, so as to act together like a parallel rule; *ac* will represent the frame of the machine, and *ab* and *cp* two spokes of the wheels. They are pinned to the board at each apex of the obstacles *b* and *p*, in order to avoid the necessity of loading the frame of the machine for the sake of obtaining adhesion; also the difficulty of proportioning that load to the spring or power, and of dividing it properly between the fore and hind wheels. It can thus be experimented on in an horizontal position, whilst the movement is precisely the same. Let him now apply a piece of bent whalebone, as a spring, between the points *d* and *i*, and be convinced that a power thus applied is capable of carrying the fulcrum *a* to a position perpendicular to the apex of the obstacle *b*. Again, let him put his finger to the point *k* of the lever *kc*, and his thumb to the edge of the board at F; let him exert a trifling pressure, and be convinced that a weight applied at that point, the action of which will thus be exactly represented, will move the machine upward and forward, and not backward, as he supposes. Let him also apply his finger and thumb to the points *r* and G, and find that he will fail of producing any other than a retrogade effect; but that if he apply them to the points *r* and *s*, an ascending locomotion will be produced, as before; showing the difference between forces whose points of reaction are within and without the machine. The whole of this little apparatus can be made, and the experiments performed, in half an hour, and is therefore within the reach of all your readers. A few cursory remarks, and I have done.

Mr. Chapman's observations on Saxula's theory are not exactly what he intended they should be—clear and comprehensive. Saxula has very acutely and satisfactorily answered them. I am sorry to find that Saxula continues unconvinced of the fact, that the fulcrum of the oar is in the boat and not in the water, though the contrary is certainly the generally received opinion. I say I am sorry, because I considered that he was quite competent to appreciate the force of my reasoning on this point in Nos. 402 and 403. I can add nothing to give further effect to what I have there stated. He says, that whilst the water moves faster than the boat, the fulcrum is in the boat, and the oar a lever of the first class; but the moment the boat moves faster than the water, the fulcrum shifts to the water, and the oar becomes a lever of the second class. I merely wish to ask him where the fulcrum is when the water and the boats move with equal velocity? The distinction of three orders in the lever is of a trifling kind, and of little use. Of what order is a lever bent to a right angle, having the fulcrum at the angle? The principal point of inquiry is, where is the fulcrum? Saxula asks, is it not at the quiescent point, or place of least motion, and requires an answer without circumlocution —a plain yes or no. I answer both yes and no—yes, as to its being at the quiescent point; and no, as to its being at the place of least motion, for if quiescent, it has *no* motion. Perhaps he means the motion of the whole lever relative to some other object, and not its angular motion. If so, I again answer no, as to its being at the place of least motion, for this may be any where and every where according to circumstances, particularly as to the direction in which the lever is worked. These distinctions will, I fear, annoy and perplex him, and be considered as another specimen of my "fine-drawn ideas;" but he may rest assured, that no progress can be made in science with vague and ill-defined ideas. There is no broad and royal road to accurate knowledge. I think I have now exhausted the subject, and I appeal to the Editor, whether any thing further can reasonably be expected from me. Indeed, I hope, from the candour which Saxula has hitherto displayed, that, to use his own words, "he will render it needless, by being candid enough to say that he has mistaken his position."

Yours, &c.

BENJAMIN CHEVERTON.

P. S.—Your indefatigable and valuable correspondent, Mr. Baddeley, has, in No. 398, referred to the much greater facility with which a carriage can be moved at the wheel than at the pole. He will, with a little attention to the subject, perceive, that a power of double the mechanical advantage is used in the former than in the latter case. There may perhaps be a little hesitation in admitting this, from the consideration, that the power is exerted in a circular direction, or rather at a tangent to the periphery of the wheel, over a space no greater than the axle or resistance is moved; but then he loses sight of the fact, that the body of the man so exerting a power, moves also with the same actuating force, over the same distance in a straight-forward direction, as the hand does in a tangential one. Thus there is a power acting in the same time, over a space double that in which the resistance moves, but not so if applied at the pole of the carriage. The two cases may be represented by a line, with a weight suspended to it, passing over a fixed pulley, and wound round the wheel of a carriage in one case, and attached to its axle in the other. Mr. Baddeley will see at once, that a one and a two-pound weight will be equally efficient in the respective cases, but that they will descend different distances. I take this opportunity of thanking Mr. Baddeley for his obliging answer to my inquiry relative to the air-chamber of fire-engines.

B. C.

PROPORTIONS OF STEAM-ENGINES.

Sir,—When differences of opinion exist on important subjects between writers of reputation, it is a matter of great consequence to ascertain which is wrong, especially when the subject is one of such consequence as "the proportions of the parts of steam-engines.

It would appear impossible to raise a question respecting the size of the air-pump of a condensing-engine, and yet I find two statements so much at variance with each other, that I submit to you whether it would not be as well to insert the following in the Mechanic's Magazine.

Tredgold, in his work on the steam-engine, page 205, article 415, states, that "the air-pump should be one eighth the capacity of the cylinder or half the diameter, and half the length of the stroke, and the condenser should be of the same capacity," and at page 177, article 350, says that, "the usual proportion in Boulton and Watt's practice, is one eighth." Now, turn to "Brunton's Compendium of Mechanics," page 122, and you will find under the head of Air-pump, that "the solid contents of the air-pump is equal to the fourth of the solid contents of the cylinder, or when the air-pump is half the length of the stroke of engine, its area is equal to half the area of cylinder—that the condenser is generally equal in capacity to the air-pump, but when convenient, it ought to be more, &c."

Both are explicit—Which is right? In Roberts's Tables, you will find similar proportions to those given by Brunton.

These works are recent ones; and if errors exist in them, discussion on them in your valuable journal will, no doubt, elicit much useful information. Practice is better than theory—therefore, I would suggest to such of your correspondents, as may favour us with information on the subject, to lay before your readers the proportions of engines that have been some time at work with such results of performance as they can obtain. I have lately seen an engine by Humble and Co., of Leeds, with a cylinder 16 inches diameter, and the air-pump 10½, and half the stroke of the cylinder.

Yours, &c. J. B.

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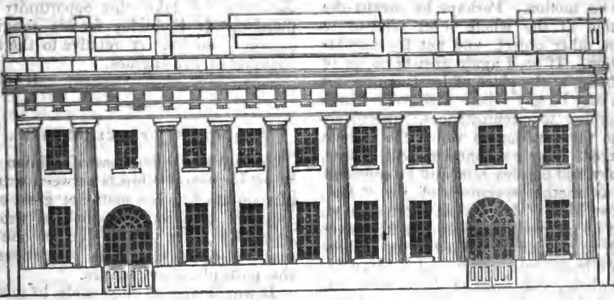
THE PANTECHNICON



The above engraving represents the principal front of a public establishment of great magnitude and utility, which is on the point of being completed in the neighbourhood of Belgrave-square; and is likely to hold in future a prominent place among the "Sights of London." It is called the Pantechnicon—a word of Greek formation, signifying that it is a repository of all sorts of arts and manufactures; but perhaps the specific objects of the establishment would be better expressed were it styled, in plain English, THE WAREHOUSE BAZAAR. It is principally intended to supply what no other existing establishment in the metropolis is capable of doing, a place of deposit for carriages, household furniture, and other bulky articles; where they may either remain in safe keeping merely, (as in the case of families leaving town), or be favourably exhibited for sale. When we went over the establishment, a few weeks ago, there were already several hundreds of carriages collected under its roof; exhibiting in their variety and splendour a scene of itself well worthy of a visit. But besides the galleries for this purpose, there are to be ranges of shops (as in other bazaars) for the exhibition and sale of lesser articles of every description; picture, reading, and auction rooms; cellars for warehousing wines, &c.

The establishment consists of two distinct buildings, the north and south, situated on opposite sides of Motcomb-street.

North Building.

The front elevation of this building is exhibited in the engraving prefixed to this notice; it is in the Doric style, and possesses breadth and boldness at least, if not elegance. The building is no less than 500 feet in length, but, in consequence of its having been erected on an irregular piece of ground, the width is neither uniform nor proportional, being in front 93 feet, and averaging throughout only 60. The front of this building is occupied by the Reading Room, Auction Room, and other offices; behind which, and separated from them by strong brick walls and iron doors, are four immense galleries for the exhibition of carriages, raised on cast-iron pillars, and connected by stone staircases. Between the iron pillars of one floor, and those above or below, there are cast-iron boxes for receiving and connecting the girders, by which means a complete iron support is produced from the ground to the roof. The whole of the ceilings, moreover, are lathed with iron (nail) rods, and covered with a composition which we are assured will resist the strongest fire, and will not crack or fall down if water be thrown against it while hot.* The boarded floors, too, are covered with iron plates, 5 lbs. to the foot superficial, which are laid upon felt, in order that the underside of the iron may be preserved from rust. And finally, all the chimney flues are provided with Smith's Patent Metallic Lining. In short, iron and stone predominate everywhere (of the former nearly 500 tons have been already used); but little wood work is left exposed, and that only in situations, where, in the event of fire, it could afford no material facility to the spreading of the flames; and thus the whole of this immense building is rendered as nearly fire-proof as possible. The principal part of the light for the carriage department is obtained from sky-lights, three of which are each 30 feet square.

South Building.

This division of the Pantechnicon has two fronts; one about 117 feet, and the other about 112 feet in length. The basement contains the cellaring for the warehousing of wines in any quantities. The ground floor is divided by two galleries; on each side of which are shops similar to those in Arcades. A corridor, in the middle of the building, connects the two galleries. Above the shops are two other floors for bazaars; each of which consists of one room of lofty dimensions in four divisions—three of which are to be connected by bridge-ways, crossing the north-ends of the galleries. The western gallery is about 105 feet long, and the eastern, 115 feet.

Not the least remarkable thing connected with this immense establishment is the fact, that it owes its existence to the enterprise of a single individual—Mr. Seth Smith, Builder (the same gentleman who is the patentee of the metallic chimney-lining.) We trust so much public spirit will not go without the reward which it merits. Mr. S. has been assisted in the planning and construction of the building by Mr. Jopling, architect, to whose professional abilities it does altogether great credit.

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"PROFESSIONAL SURVEY OF THE OLD AND NEW LONDON BRIDGES."

(Second Notice.)

The description given in this "Survey" of the new bridge, in its complete state is very ample, and conceived throughout in terms of high admiration. We shall extract such passages as are likely to present most novelty to our readers:—

"It would be to describe but feebly the merits of this structure, were we to say, that it is greatly superior to any of its fellow-bridges over the Thames. We do not think it has its rival in the world. Never have we seen, or heard, of a bridge which at once satisfied so completely popular taste, and the demands of science. We have viewed it in every variety of aspect, and seen only more and more cause for the most unqualified admiration. Not a single blemish,—not a single incongruity,—not a single superfluous ornament,—nay, not any thing whatever of the nature of mere ornament,—intrudes itself on the eye. You behold realized the perfection of proportion, and the true greatness of simplicity. You see and feel, at once, that it is a structure about which all men must be agreed, and will continue to agree, to the end of time.

"The bridge consists of five semi-elliptical arches. The least of these is larger than the largest stone arch of this description ever before erected. The centre one is 152 feet in span, with a rise above high-water mark of 29 feet 6 inches; the two arches next the centre are 140 feet in span—rise, 27 feet 6 inches; the two abutment-arches, 130 feet in span—rise, 24 feet 6 inches. A few years ago, Blackfriars and Waterloo Bridges were considered the largest elliptical stone-bridges ever known; but the centre-arch of the one is less by one-half, and that of the other by one-fourth, than the centre-arch of New London Bridge.

"The piers which sustain these noble arches are of a rectangular form, and perfectly solid, but without the slightest appearance of heaviness. The great diminution in the total quantity of masonry, effected by the adoption of the semi-elliptical curve in the arches, has enabled the architect to reduce the piers in thickness much beyond the usual proportions. In Westminster Bridge the thickness of the piers is about one-fourth the span of the arches; in Blackfriars about one-fifth; in New London Bridge less than one-sixth. The bases of the piers are of a circular cone-topped form, and project boldly into the stream, harmonizing well with the waving line of the water, and breaking, with admirable effect, the impression of tameness that would otherwise have resulted from the rectangular shape and rigid plainness of the shafts.

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* We are promised the receipt for this composition, and hope, shortly, to communicate it to our readers.

"A simple modillion cornice runs along the upper part of the bridge,—marking externally the line of the roadway,—and is surmounted by a close parapet, which recedes in two elevations, like the scamilli of the ancients. When it was first known that the bridge was not to have an open balustrade as usual, an apprehension was generally expressed that the effect of the plain double blocking course would be dull and heavy; but now that people see what the effect really is, we hear of nobody being of this opinion. It forms, indeed, one of the most effective of those features of simplicity, which characterize the bridge; for, notwithstanding the preference which has been generally given to open balustrades in bridges, the truth is, there is but little natural accordance between pigmy pillars and gigantic piers,—small peep-holes, and lofty, wide-spreading, arches. The parapet is only four feet high, so that passengers, though they cannot look through, can look over, with ease.

"The line of the roadway, or upper surface of the bridge, is a segment of a very large circle; the rise being only about 1 in 132. The two inches of additional height which were given to the abutment-arches, by the advice of the present Mr. John Rennie,* have helped to flatten this line considerably; and, no doubt, this was the chief object which Mr. Rennie had in view.

"The abutments are each 73 feet wide at the base, and radiate backward, so as to meet the thrust of the bridge with the best advantage. Alongside of them are two straight flights of stairs, 22 feet wide, which lead to and from the water.

"So just have been the calculations, on which the relative bearings of every part of this bridge have been adjusted,—and with such exactness has every stone been shaped and placed, according to the working plans,—that the sinking which takes place, in all such structures, has been, in the present instance, unprecedentedly small. The centre arch has only sunk 2 inches; those next to it 2½; and the abutment arches 2. The sinking of Waterloo Bridge, which was thought, at the time, to be wonderfully small, was five inches."

A very high character is given of the late Mr. Rennie, the designer of the bridge: -

"Mr. Rennie, whose plan of a new bridge was preferred by the Corporation—so justly preferred, in our opinion—and specially ordered by the Act of Parliament to be followed, died before the first steps were taken to carry it into effect. Unhappily for that art, with some of the noblest monuments of which his name is identified—unhappily for that country which he so greatly embellished by his labours, he was snatched away by the hand of death, while yet in all the vigour of his faculties. His merits as an architect have been questioned; but now that time must have gathered to oblivion nearly all the envy and enmity with which his professional success was regarded by his contemporaries (we say "nearly all," for there are men, as there are women, of a certain age, who never forget lost opportunities)—now that days and years enough have elapsed to enable every one to contrast the employments heaped upon him, with their actual and enduring results,—we may assert, without much fear of contradiction, that there never was a high reputation more fairly earned. It owed its rise and growth neither to lucky accident, nor trucculent artifice. Talent, industry, prudence, perseverance,— boldness of conception,—soundness of judgment,—and habits of untiring application, — these were the elements of the good fortune of John Rennie."

An interesting sketch of the particulars of Mr. Rennie's life is given, by way of note, to the passage we have just quoted :—

The "Survey" closes with some strong remarks on the probable effects of the removal of the old bridge on the navigation of the river. The following extracts exhibit some new facts.

"It will be recollected, that it was in order to compensate for the additional obstruction, arising from the coffer-dams employed in the erection of the new bridge, that two arches, on each side of the old bridge, were converted into one. Of course, now that these coffer-dams have been all removed, the river has the full advantage of the additional width which this conversion gave to the ancient water-way. Now, mark the result,—the fall, at the Bridge, has been already reduced fifteen inches, and the water, at spring tides, rises two feet higher than it ever did before. If such an effect has been produced by so partial a diminution of the ancient dam, what may not be expected when it is reduced altogether? Even before the dam was lessened, it was unable to prevent high spring tides attaining an elevation above bridge, greater than the walls, on either side of the river, could withstand, — such a spring tide, for example, as that of the 28th December, 1821, when the whole of the up-country was so flooded, that boats were the only means of communication, where boats had never been seen before, time out of mind. We have no disposition to be alarmists; but we think the most sober-minded must be startled by such facts as these. We hope they will yet be well considered, before so powerful a river as the Thames is let *entirely* loose from its ancient bonds, on its low-laying and comparatively unprotected shores; peopled and occupied, as they have been, in the full confidence that as the river had been for centuries, so it would be allowed to remain."

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* Now, most deservedly, *Sir John Rennie.*

* * *

"But the injury that may result from the danger in *the flow* of the tides constitutes, as we have seen, only one view of the case; that which is anticipated from the change in *the ebb*, is of scarcely less magnitude. The navigation suspended for an hour or two every tide; the foundations of all the other bridges over the river, and of many of the wharfs and houses on its banks undermined; the quantity of pestilential mud prodigiously increased;—such are a few of the consequences which we are taught to expect will result from the scouring, or rather dredging, velocity given to the ebbing tide, and the entireness of the overflow at each ebb. And though these are effects which must, from their nature, be slow of demonstrating themselves, there are not wanting, even now, very sure indications of their approach. We have seen that, through the partial widening of the waterway of the old bridge, the scouring process has been already commenced,—nay, has gone on to a considerable extent; the fall has been lessened,—that is, the dam has been cut down, to *the extent of fifteen feet*."

We committed a slight mistake last week in giving the title of this pamphlet, in consequence of our having seen a proof copy of it only. It consists of 48—not 36—pages; and instead of a vignette portrait of Mr. Rennie, we have an extremely good likeness of him in a separate plate, fronting the title-page. The cheapness of the pamphlet is, even in these days of cheap publishing, extraordinary. It is not often that three closely-printed sheets of letter-press, with wood cuts interspersed, thirteen illustrative plates, and a portrait, are to be had for half-a-crown.

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A BRIEF ACCOUNT OF THE FIRE-ENGINE ESTABLISHMENT IN THE CITY OF EDINBURGH.

Sir,—The very defective state of the means of extinguishing fires in Edinburgh, had for some time attracted notice; but the public attention was more particularly called to it in consequence of the fire which occurred in Niddry-street, in February, 1824—a subsequent fire in the New Buildings, North Bridge-street, in March following—and the fire opposite the Royal Exchange in June that year—which first drew the attention of the Commissioners of Police to the subject, in consequence of the very conspicuous want of efficient assistance on these occasions, and the manifest defect in the application of the very inefficient force which could then be procured; arising from the defective co-operation on the part of those who had fire-engines, and the want of regularly-trained firemen, which rendered it indispensable to accept the aid of any one willing to afford it, whose assistance, consequently, could neither be depended upon, nor enforced, longer, or in any other shape, than the party might be disposed to give it.

These circumstances led the Commissioners of Police to take up the subject; and they appointed a committee of their number, who held various meetings with several of the Magistrates, and the Managers of the Fire-Insurance Companies, with the view of organising an efficient system; and a subscription was entered into by these parties for the purpose of defraying in part the annual expense; it being agreed that the deficiency should be paid out of the Police funds.

But before it was possible to procure and train a body of firemen, or to perfect any other arrangement, the alarming fire in November, 1824, took place, when the total want of efficient fire-engines, and of unity of arrangement or co-operation on the part of those to whom the existing ones belonged, became still more conspicuous, and the alarming extent to which these fires went, notwithstanding the unwearied exertions of all classes of the inhabitants, forcibly recalled the attention of the Police Commissioners to the subject; more especially, as the whole of the engines were then rendered unserviceable, and the town was in some degree left destitute of that indispensable means of protection in the event of the recurrence of a similar calamity.

The Committee, therefore, again held various meetings with the Magistrates and Managers of the Fire-Insurance Companies, with the view of ascertaining as accurately as possible the probable expense of organising a fire-engine establishment on the principles before agreed upon. After consulting on these points with the Magistrates, and Managers of the Fire-Insurance Companies, some of whom had previously kept fire-engines, it appeared that a sum of £1400 sterling would be adequate to the formation of the establishment, and that an annual expenditure of £500 would be sufficient to keep it up.

The first of these sums, being the calculated expense of outfit, was very handsomely agreed to be defrayed by the Magistrates, and by the six following Insurance Companies, viz. the Edinburgh Friendly, the Caledonian, the North British, the Hercules, the Scottish Union, and the Insurance Company of Scotland, each of whom agreed to contribute £200 sterling.

These calculations of expenditure, and arrangements with the Magistrates and Insurance Companies, having been reported to the Board, and that, by consequence, an annual expenditure of from £150 to £200 only would be requisite on their part, the Commissioners of Police came to the resolution, that, in the mean time, they would consent to take the charge of the establishment upon themselves, though under the reservation of full power to abandon it, should the subscription of the Insurance Companies be withdrawn or diminished, or the extra expense be found to exceed what the Board might consider proper to be defrayed by the public.

In consequence of this arrangement, the Police Committee continued their exertions, and in the first place procured and trained, by regular exercise, a body of 80 firemen, under the command of a superintendant and other officers.

The Committee also purchased for the establishment three large new London-made fire-engines, requiring 20 men each for their proper working—five of a more portable description—and six small hand-engines. These engines they furnished with a very complete equipment of hose, screws, &c. &c., as also with the necessary apparatus for the purpose of fire-escape.

This done, the Committee next turned their attention to the water-supply, the then existing arrangements of which they found to be quite inadequate to their purpose. After consulting with several skilful persons, the Committee came to the resolution of substituting fire-cocks of a new and improved construction, for such fire-plugs as were then in existence, and to increase their number to such an extent as would give efficiency to their other arrangements. The resolution of the Committee, like all the former ones, was carried into execution with great spirit; and the Committee have up to January, 1830, erected 163 new fire-cocks within their district, besides putting all the old ones into good repair, in doing which they have expended upwards of £1000.

In the course of the two first years of the existence of the fire-establishment, it became evident that the calculations of annual expenditure had been greatly underrated; and, that, instead of £500 per annum being sufficient, as was expected, for the purpose, less than £800, or from that to £900, would not maintain the establishment in an efficient state. Accordingly, the city of Edinburgh augmented their annual subscription from £50 to £80 per annum, while the offices of the Caledonian, North Britain, and Insurance Company of Scotland, increased their subscription from £20 to £32 per annum; and the Scottish Union, Hercules, and Edinburgh Friendly Insurance Companies, liberally extended the amount of their subscription to £60 per annum. The London fire-offices having agencies in Edinburgh, however, declined making any addition to *their* former contribution.

The present number of firemen in Edinburgh is 50, divided into 4 companies; 3 of which consist of 12, and one of 14 men. The bounds of the city are divided into 4 districts; in each of which there is an engine-house, containing one or more engines, one of the companies being attached to each engine-house. In each company there is one captain, 1 serjeant, 4 pioneers, and 6 or 8 firemen.

The whole are dressed in blue jackets, canvass trousers, and hardened leather-helmets, having hollow leather crests over the crown to ward off falling materials. The form of this helmet was taken from the war-helmet of the New Zealanders, with the addition of the hind-flap of leather. In front the helmet has a brass plate; and behind there is a projecting flap of leather, to prevent burning matter, melted lead, water, or rubbish, from getting into the neck of the wearer. The captains' helmets, besides the brass plate in front, have 3 small ornaments, those of the serjeants 1, those of the pioneers and firemen being plain.

The jackets of the captains have 2 small cloth wings on the shoulder, similar to those worn by light infantry. Those of the serjeants have 3 stripes on the left-arm; and, on the left-arms of the pioneers and firemen are their respective numbers in the company.

Each company has a particular colour —red, blue, yellow, and gray. Each engine is painted of one or other of these colours, and the accoutrements of the men belonging to it correspond. There is thus no difficulty in distinguishing the engines or men from each other by their colours and numbers. Each also wears a broad leather waist-belt, with a brass buckle in front.

To the waist-belt of the captains, serjeants, and pioneers, is attached 80 feet of cord; the captains have also a small mason's hammer, with a crow-head at the end of the handle: the serjeants have a clawed hammer, such as is used by house-carpenters, with an iron handle, and two openings at the end for unscrewing nuts from bolts; the pioneers a small hatchet, with a crow-head at the end of the handle; and the firemen each carry a canvass water bucket folded up.*

The captains assemble every Tuesday night to give in a report of such fires as may have occurred in their respective districts, with a list of the men who have turned out, and a corresponding list from the serjeant of police of the respective districts. They then receive any orders which may be necessary; and any vacancies which have occurred in the establishment are filled up at these meetings.

(To be concluded in our next.)

BURSTING OF WATER-PIPES.

Sir,—Observing several statements in the Mechanics' Magazine respecting the bursting of water-pipes after frost, I beg to submit to the notice of your readers the following *facts*. One Saturday, last winter, I sent for a jug of water to wash my hands, and left it about half full. When I came to look for it on Monday morning, I found the jug lying in two halves, and the water converted apparently into a solid body of ice; but on the ice being broken, there was a fluid in the inside, which soon froze upon being exposed to the air. One or two days after, a quart decanter was left full of spring-water, which froze without breaking the decanter, as I expected it would have done; but upon putting it on a stove, to thaw the ice, it split entirely down one side.

Yours, &c.

William Champion.

High-street, Peckham, Aug, 15, 1831.

Remarks.

The *first* of the incidents mentioned by Mr. Champion is an illustration of the familiar fact, that bodies of water freeze gradually from the outside, whence follow two or three consequences, not perhaps so familiar to common observation, which we shall take the present opportunity of pointing out. One is, that when water is placed in an erect globular vessel, so as to be exposed to the frost on all sides, the solidification may and does stop frequently short of the centre. Another, that as the freezing goes on, each particle of water must part with its heat to the particles inside of it. And a third, that as long as any portion of water remains in the centre in a liquid state, it serves as a recipient for all the heat disengaged and sent inwards; but that when there is no such recipient—when the entire body of water has become solidified—the accumulated heat must of necessity burst its barriers, and the ice, as well as vessel containing it, fly in pieces.

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* Described in Mech. Mag. p. 440, vol. xiv.

We hope these explanations will suffice to remove the doubts which two or three correspondents have expressed, with respect to the accuracy of the view we took, in our last number, of the process by which ice explodes.

Mr. Champion's second incident has not that bearing which he seems to intend it should have on the question lately discussed, with respect to the effects of thawing. The breaking of the decanter arose, in this case, from the suddenness with which it was exposed to the extreme heat of the stove: between which, and any rise in the temperature of the atmosphere, there is evidently no analogy.—Ed. M. M.

◆

PITCAIRN ISLANDERS.

We mentioned, in our Review of Capt. Beechey's Voyage to the Pacific, that the British Government had given a favourable answer to an application from the descendants of the Mutineers of the Bounty, to remove them from Pitcairn's Island to some of the larger islands of the South Sea. It now appears, from the American Papers, that the removal has been actually effected. The captain of a whaler, which arrived lately at New York, reports, that while at Otaheite the English transport-ship, Lucan, came in there with all the inhabitants of Pitcairn's Island, with the purpose of fixing them in a settlement at Otaheite.

◆

HAIL-RODS (Paragrêles).

It is now more than 50 years since it was first proposed by men of science in France, to avert the calamities which that kingdom sustains in a very peculiar degree from hail-stones, by erecting conductors, with a view of drawing off the electricity that was supposed to generate the storms. The land proprietors, however, did not display eagerness to avail themselves of the proposed security; and a writer complains that for thirty years afterwards not a single landholder had put the experiment into practice (Phil. Mag. vol. xxvi. 218). But as late as the year 1821, the Linnæn Society of Paris revived the interest on this subject, and caused numerous experiments to be made, which have inspired, it appears, much confidence in the efficiency of hail-rods. In a late Number of the Annals of that Society the subject is thus noticed:—

> "The Paragrêle, or hail-rod, has for several years occasioned much inquiry on the Continent, and has engaged the particular attention of the Society. In many districts which were formerly year, after year, devastated by hail, the instrument has been adopted with complete success; while in neighbouring districts not protected by paragrêles, the crops have been damaged as usual; and the Society are receiving from all quarters, statements which fully confirm their opinion of the utility of the invention. The Society have made a Report to the Ministers of the Interior, recommending that measures be adopted by the general Government for the protecting the country from hail; and it is estimated, from the result of experiments in numerous districts, that if paragrêles were established throughout the whole of France, it would occasion an annual saving to the revenue of fifty millions of francs."

MESSRS. BRAITHWAITE AND ERICSSON'S BOILERS.

The correction of an *error of the press* in the article under this title in our 417th Number, will satisfy "A Detester of *Falsehood*" that a less fierce name might have suited the occasion. In the last line but one, for "fuel," read "sawing," and all will be right. Sawyers and carpenters will readily understand how such a saving is effected, when we mention, that at the establishment alluded to a 9 inch plank, 13 feet long, is cut through in one minute!

APPEARANCE OF A NEW ISLAND IN THE MEDITERRANEAN.

On the 10th of July, about eleven o'clock in the morning, Captain Jean Carrao, master of the brig *Theresine*, in his voyage from Trepani to Girgenti (Sicily), being at the distance of about twenty miles from Cape St. Marc, perceived, at the distance of a gun-shot, a large quantity of matter, nearly sixty feet above the level of the sea; and which, in circumference, appeared to be four hundred fathoms. At the same time the air was impregnated with sulphur.

On the previous day, in the gulf of the *Trois Fontaines*, he had seen a great number of dead fish, and a great quantity of black-pumice stone, floating upon the water; and had heard a loud noise resembling thunder, which he attributed to a volcanic eruption.

He continued his voyage to Girgenti; and, during all the time he was loading his ship, he continually saw a thick smoke rise from the same point; and when he returned, on the 16th, from Girgenti, a new spectacle presented itself to his eyes,—an island, of about the same circumference as the water which he saw on the 10th. This island, which has been named Carrao, from the Captain who first saw it, is about 12 feet above the level of the sea; it presents, in the middle, a flat surface, and the crater of a volcano, from which lava was seen to issue during the night. A mist being over the shore, the soundings, all round the island, gave a depth of 100 fathoms. It is situated 37° 6′ latitude north, and 10° 26′ longitude east of Paris.

Such is the report of Captain Carrao, who entered the port of Marseilles on the 30th of July. Captains of other vessels have since seen this island, and confirmed the above report.—*Semaphore de Marseilles.*

THE IMPERIAL STANDARD GALLON.

Sir,—With a view of saving the time of making calculations, I purchased a small book, entitled, "A Series of Tables of the areas and circumferences of circles of different diameters, &c. &c., printed and sold for the author, by J. Ogle; sold also by Longman and Co. London." At the end of the preface is this notice: "Erratum.—In the head-lines of each alternate page, from p. 9 to 41, the *datum* of an imperial standard gallon, 277·274, should be rendered 267·774."[*] I then turned to a table of specific gravities at the end of the book, and there found :—"Water, *distilled* 1000, 62·50 lbs. per cube foot, and 27·64 inches to a lb." Meeting with three such various statements in the course of a few pages, I referred to the Scientific Adviser, by J. Haviland, and found, at p. 214, that "From the 14th section of the Act, it appears that the new standard gallon is to contain 277·274 cubic inches, &c." and at p. 215, "From the 1st day of January, 1826, the standard measure of capacity, as well for liquids as dry goods not measured by heaped measure, shall be the gallon, containing 10 pounds avoirdupois weight of distilled water, weighed in air at the temperature of 62 degrees of Fahrenheit's thermometer, the barometer being at 30 inches, &c. &c." Not feeling satisfied, I then multiplied 1728, the number of inches in the cube foot by 10, the number of pounds in a gallon, and divided the product by 62·5, the weight of a cube foot also in pounds, which gives 276·48 as the number of inches in a gallon. In this perplexity I turned to the Mechanics' Magazine, which I searched through, from its commencement, but could find nothing but a repetition of 277 274 as the contents of the imperial gallon. Now, Sir, unless these contradictions can be cleared up by some of your many able correspondents, (Mr. Woollgar, perhaps) I see no alternative, but must crave their assistance in obtaining an act to reduce the weight of a cube foot of water, or to add 4·9625 cubic inches to its contents.—Yours, &c.

TREBOR VALENTINE.

Derby, July 24, 1831.

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[*] It appears, in the work, that this should be reversed, as 267 774 is what is given in the pages specified as above.

INTERIM NOTICES.

Autographs.—As we intend giving shortly a second sheet of autographs of eminent men of science, engineers, and mechanics, we shall be glad to be favoured with any names not included in our first collection, and which may be thought entitled to a place in this supplement.

Communications received from J. B. (an Apprentice)—J. L.—Mr. Ryan—A Waterman—Quid—L. M.—Mr. Wise—J. B. (on Street-Paving)—Mr. Gunby—G. E. M.

Errata.—In part of the impression of our 417th Number, it was omitted to be stated that the article on Teak Timber was extracted from the *United Service Journal* for the present month.

P. 341, col. 2, l. 8 from the bottom, for "comb-burning-damp," read "comb becoming damp."

Sir,—In reading the communication you have done me the honour of inserting in your 417th No. p. 357, I perceive Fact 4 does not express the meaning intended. It should have been, that "air and water separated, occupy a larger space than when combined."—Yours, &c.

PROFESSOR OF USEFUL KNOWLEDGE.

July 8, 1831.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office Court, Fleet Street; where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

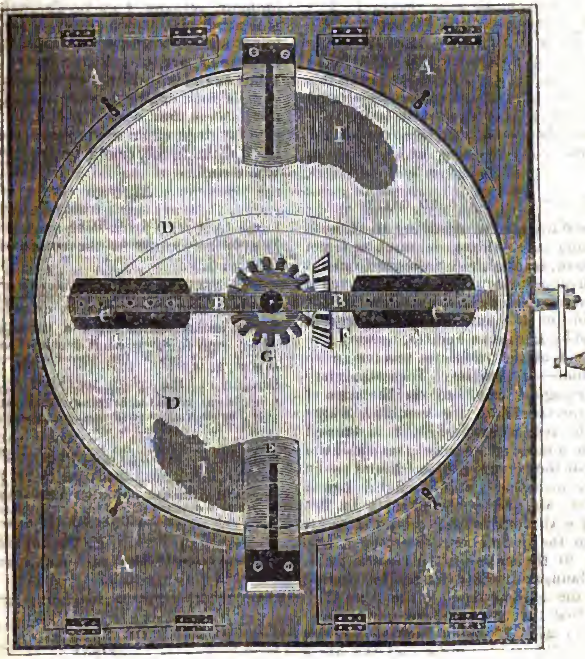
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 420.] SATURDAY, AUGUST 27, 1831. [Price 3d.

> " ——— While thus laborious crowds
> Ply the tough oar, Philosophy directs
> The ruling helm ; or like the liberal breath
> Of potent Heaven, invisible the sail
> Swells out, and bears th' inferior world along.—THOMSON.

HENDERSON'S HORIZONTAL ELECTRICAL MACHINE.



HENDERSON'S HORIZONTAL ELECTRICAL MACHINE.

Sir,—I have lately contrived an electrical machine, which works horizontally, and appears to me to unite in so eminent a degree the three desirable properties of simplicity, portability, and efficiency, that I am induced to believe I shall be doing a service to the cultivators of experimental philosophy, by sending a description of it, to your valuable repository of new inventions and improvements.

The accompanying sketch represents the square frame of the machine, in which is cut a circular space sufficiently large to allow the plate-glass cylinder, when revolving, to do so freely without touching: and deep enough to admit of the upper surface of the cylinder being, at least, about one inch under the surface of the square frame (the reason for this will be understood from the sequel of the description.) In the centre of the frame is erected a brass tube (by being made fast by screws to the bottom) and in this tube is inserted a spindle, so nicely fitted and well polished as to turn in the tube with perfect ease. On the top of the spindle is cut a square, which is inserted into that of the glass cylinder, DD, and is made fast to it by means of a nut and screw. On the under end of the spindle is fixed the small wheel G, with its bevel teeth; this wheel must be taken off when the cylinder is to be removed out of its place, and replaced when again inserted in its tube. Another similar wheel F is pitched, and working exactly into the wheel G, causes the glass cylinder DD to revolve with the greatest freedom. This last mentioned wheel is fixed on the axis of the handle H of the machine, which axis turns in a brass tube that is screwed to the bottom of the machine. E E are the two rubbers or cushion frames; made of red leather, stuffed tightly with curled hair, and so packed as to lie flat on the surfaces of the plate-glass, attached to which are pieces of black silk I I, for confining the electric fluid. On the back of these frames springs are screwed (as represented in the engraving) for preserving the spring of the cushion. C C represent the prime conductors united together by means of the brass bar B B. The conductor should be made of brass tubing, such as is used for gas purposes. The prime conductor has ten points inserted in its under surface for the accumulation of the electric fluid.

The conductor, with its apparatus, must in the present machine be considered as distinct from the rest of the apparatus. It is made fast to a short glass pillar, on the under surface of the lid of the frame, but could not be introduced into the drawing with effect. When the lid is put on the large square frame (which is done by means of the small projecting studs of wood at each corner of the frame), it leaves the points of the prime conductor at least two tenths of an inch above the upper surface of the glass plate. It will be observed, that in the engraving there are two cross marks on the upper surface of the conductor; these are intended to intimate, that the two pins adjoining are prolonged, and come through to the upper surface of the lid. On the tops of these pins are placed two brass balls, about one inch in diameter, for operating with, in conducting experiments. When the lid is on the frame A A A A, nothing is to be observed on the top save the two balls of the frame conductor, so that the whole surface of the lid is left clear for the operator. At each corner of the frame, there are small triangular-shaped boxes (A A A A) for holding such articles as may be wanted in the course of experimenting.

This apparatus may be made of any required dimensions, but a cylinder of fifteen inches diameter, and three-tenths of an inch thick, is what I would recommend as amply sufficient. This modification of the plate machine will be found highly advantageous for lecturers,—for Mechanics' Institutions—or country philosophical societies—as it can be transported to any place without risk of danger being sustained, as is too much the case with the common ones in use.

Yours, &c.

E. Henderson.

Liverpool, April, 1831.

P.S.—Of course the machine must be insulated by means of glass pillars at each corner of the frame; they may be about 3 inches in length.

E. H.

A BRIEF ACCOUNT OF THE FIRE-ENGINE ESTABLISHMENT IN THE CITY OF EDINBURGH.

(Concluded from last Number.)

For some months after this fire-establishment was organized, the men were regularly drilled once a-week, at four o'clock in the morning; but now, only once a-month at the same hour. Among many other good reasons for selecting this early hour, is, that it does not interfere with the daily occupation of the firemen. The chance of collecting a crowd is also avoided, as there are then comparatively few people in the streets; this is a matter of some importance, as a crowd of people not only impede the movements of the firemen, but, from small quantities of water spilt on the bystanders, quarrels are generated, and a prejudice excited against the corps, to avoid which every exertion should be used to keep the firemen on good terms with the populace.

The mornings, too, at this early hour, are dark for more than half the year, and the firemen are thus accustomed to work by torch-light, and sometimes without any light whatever, except the few public lamps which are then burning. And, as most fires happen in the night, the advantage of drilling in the dark must be sufficiently obvious.

The inhabitants have sometimes complained of being disturbed with the noise of the engines at so early an hour; but when the object has been explained, they have generally submitted, with a good grace, to this slight evil. A different part of the city being always chosen for each successive drill, the annoyance occasioned to any one district is very trifling, and of very unfrequent occurrence.

On the Tuesday evening preceding the drill, the captains are informed when and where the men are to assemble. These orders they communicate to the individual firemen. A point of rendezvous being thus given to the whole body, every man, who is not on the spot at the hour appointed, fully equipped, with his clothes and accoutrements in good order, is subjected to a fine. Arrived on the ground, the men are divided into two parties, each party consisting of two companies, that being the number required to work each large engine, without any assistance from the populace. The whole are then examined as to the condition of their clothing and equipments.

The captains, serjeants, and pioneers of each company, alternately take the duty of directing the engine, attaching the hose, &c., while the whole of each party not engaged in these duties take the levers as firemen.

The call being given to move forward, the men set off with the engine at a quick walking pace, and, on the same call being repeated, they get into a smart trot. When the call to stop is given, with orders to attach one or more lengths of hose to the engine and fire-cock, it is done in the following manner: No. 1 takes out the director or branch, and runs out as far as he thinks the hose ordered to be attached will reach, and there remains; No. 2 takes a length of hose out of the engine, and uncoils it towards No. 1; and No. 3 attaches the hose to the engine. If more than one length is required, No. 4 takes out another, couples it to the former length, and then uncoils it. If a third length is wanted, No. 3 comes up with it, after having attached the first length to the engine. If more lengths are still wanted, No. 2 goes back to the engine for another; Nos. 3 and 4 follow, and so on until the requisite length is obtained; No. 1 then screws on the director at the farther extremity of the last length. While Nos. 1, 2, 3, and 4, are attaching the hose to the engine, No. 5 opens the fire-cock door, screws on the distributor, and attaches the length of hose, which No. 6 uncoils; Nos. 7 and 8 assist, if more than one length of hose is required.

Immediately on the call being given to attach the hose, the serjeant locks the fore-carriage of the engine, and unlocks the levers. The fire-cock being opened by No. 5 (who remains by it as long as it is being used) the serjeant holds the end of the hose which supplies the engine, and at the same time superintends the men who work the levers. The call being given to work the engine, the whole of the men, Nos. 1, 2, 3, 4, and 5, the captain and serjeant excepted, work at the levers along with the men of the other company.

Although these operations may appear complicated, they are all completed, and the engine in full work, with three lengths, or 120 feet of hose, in one minute and ten seconds, including the time required for the water to fill the engine so far as to allow it to work.

In order to excite a spirit of emulation, as well as to teach the men dexterity in working the engines, a competition is frequently caused amongst them. They are ordered to attach one or more lengths of hose to each of two engines, and to work them as quickly as possible, the first engine which throws water being considered the winner. They are sometimes also placed at an equal distance from each of two separate fire-cocks; on the call being given to move forward, each party starts for the fire-cock to which it is ordered, and the first which gets into work is, of course, held to have beat the other. The call to stop is then given, and both parties return to their former station, with their hose coiled up, and every thing in proper travelling order; the first which arrives being understood to have the advantage.

The men are also carefully and regularly practised in taking their hose up common stairs, drawing them up by ropes on the outside, and generally in accustoming themselves to, and providing against every circumstance, which may be anticipated in case of fire.

Within the last four years, the only two firemen who have lost their lives, were run down by their own engines; and, in order to avoid danger from this cause, they are frequently accustomed suddenly to stop the engines, when running down the steep streets with which the City of Edinburgh abounds. It is a highly-necessary exercise, and is done by wheeling the engine smartly round to the right or left, which has the effect of immediately stopping its course.

Some idea may be formed of the service of the fire-engine establishment, from the following table, which exhibits the number and nature of the fires which have occurred in each year since the formation of the corps.

Years.	Total Losses.	Considerable Losses.	Trifling Damage	Foul Chimneys.	False Alarms.	Total.	Observations.
From 1st Oct. 1824-5.	11	12	14	9	2	48	
1825-6	7	18	31	17	7	80	
1826-7	1	12	55	39	6	113	The total loss this year was a boat builder's shed on the banks of the canal.
1827-8	1	18	43	28	4	94	The total loss was a wright's shop, of wood, value, with contents, under £50.
1828-9	1	9	56	118	10	194	The total loss was a smith's shop, of wood, with contents not exceeding £30 in value.

On examining this table, it will be observed, that serious fires decrease as the number of alarms increase. The cause of so many alarms in 1828-9 was, that a considerable number of fires having been observed to arise from foul chimneys, the firemen were sent to every one from which the slightest danger was apprehended.

The number of houses and of the assessable places within the Edinburgh Police-bounds, is 29,000, including that place which pays a separate rent, although there are sometimes several of these under one roof. The average of fires for the above five years, is about 105, inclusive of such cases of foul chimneys as have been considered dangerous; being one fire to each 276 houses.

In Paris, from an average of 20 years, it is found that 540 fires happen annually, and as the number of houses is supposed to be 26,000, this gives rather more than 2 fires per 100 houses. Owing, however, to the promptitude and efficiency of the corps of *Sapeurs Pompiers*, the amount of loss is computed to be so small as 1·23,000 of the whole, or about the value of one house burned out of 500 which catch fire.

The complete success, which has so pre-eminently distinguished the exertions of the Edinburgh Fire-establishment, reflects the highest credit upon the gentlemen who planned and organised, as well as upon all who have in any way contributed to bring it to its present state of practical efficiency; especially on Mr. James Braidwood, the master of fire-engines, who, whether we consider his good judgment in the selection and arrangement of the apparatus—in training and directing the movements of his men—or his steady coolness, self-possession, and intrepidity in cases of fire—is alike entitled to honourable mention.

Those who take an interest in these matters will find the origin, formation, and proceedings of the Edinburgh fire-engine establishment, with the financial documents, and a very interesting account of the apparatus, regulations, &c., fully detailed in a small volume published by Mr. Braidwood,* and to which I am happy to confess myself indebted, for all the information contained in this communication.

The apparatus, &c., I shall have occasion hereafter to describe, as well as some other interesting particulars. In the mean time, I would wish to call the particular attention of the inhabitants of this metropolis to the important subject of a fire-establishment, here, on principles similar to those so successfully adopted in Edinburgh. Of the immense utility of such an arrangement every body must feel convinced, and the obstacles to its formation are neither so numerous, nor so formidable as many persons may, at first sight, imagine.

Yours, &c.

W. BADDELEY.

SMOKE-JACKS.

Sir,—The reply given in p. 176, vol. xv. to the query respecting smoke-jacks, is not a direct one. There *are* such things as smoke-jacks with vertical flies; a patent was either taken, or proposed to be taken, for them, some years ago by a builder of the name of Thin. A good number were put up in Edinburgh, of which some are still going well, but many of them have since been replaced by the horizontal flies with vertical spindles; the supposed advantages were the removing of the pivots and air-boxes from the direct influence of the heated current, and the simplification of the construction. The necessarily great bulk of a wheel whose diameter must be at least three times the width of the chimney, is one of the objections most frequently made to it. Most of those made here have been by Ritchie, Ironmonger to the King, No. 241, High-street.

Yours, &c. J. R.

Edinburgh, Aug. 2, 1831.

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TIDES AT OTAHEITE.

Sir,—I beg, through the medium of your widely-circulated journal, to draw the attention of the scientific portion of the public to a very singular fact.

Kotzebue, the Russian navigator, in his voyages, lately translated and published in this country, asserts, that at Otaheite the time of high-water is *precisely at noon, every day*. all the year round. As Mr. Kotzebue is, in my judgment, but a dashing writer, and falls into many geological and other blunders, and was, besides, only about ten days, or a fortnight, at Otaheite, I felt, I confess, very sceptical as to the truth of this startling assertion. But, shortly after I had read his book, I had an interview with Mr. Bennett, who visited Otaheite as one of the stations of the London Missionary Society. On inquiring of this gentleman as to the correctness of the assertion of the Russian navigator, he confirmed it, unhesitatingly. He assured me, that at Otaheite the tide is at the highest *every day at noon, and every night at midnight;* and that the time of low-water is, as uniformly about 6 o'clock in the mornings and evenings, at which hour portions of the surrounding coral reefs, which are under water at noon and midnight, are quite dry, and can be walked upon without inconvenience.

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* "On the construction of fire-engines and apparatus, the training of firemen, and the method of proceeding in cases of fire. By James Braidwood, Master of Fire-engines in Edinburgh."

Let the position of Otaheite, in the midst of the Southern Pacific Ocean, be called to mind, and then let this singular fact be meditated upon. Can it be easily reconciled with the received theory of the tides? or, must it remain as an unexplained anomaly? These are questions which I refer to the talents and research of your readers.

Yours, &c. O. C. F.

Aug. 22, 1831.

"THE VOICE OF HUMANITY.*"

The efforts which have been made of late years, to put an end to the many cruel practices by which men are accustomed to mark their dominion over the lower animals, have been but too commonly regarded as proceeding from a refinement of feeling, which it is no reproach to a person to be a stranger to, and even no great sin to laugh at outright. The intimate connexion which subsists between mercy to the brute creation, and the happiness of men themselves, has been but little suspected by the multitude, and only well understood by a few. Liberty and justice are in all men's mouths, while not one in a thousand, can be brought to lend a willing ear, when it is proposed to strike at the root of that cruelty of disposition, which makes of men, tyrants and oppressors. Familiarity with spectacles of animal suffering—familiarity with the lash, the goad, the rowel, and the knife—these are the things which harden the natures of men, and prepare them to be as harsh and cruel to their fellow men, as to the beasts beneath them. Had the brute tribes only suffered less at the hands of men, it is morally certain, men would never have suffered so much as they have done at the hands of each other.

Entertaining these impressions on the subject, it was with peculiar pleasure we lately noticed the commencement of the journal, the title of which is at the head of this notice. "The Voice of Humanity" is published quarterly, and is the organ of a benevolent association which has been formed for the special purpose of procuring a mitigation of the sufferings of the brute creation. The design of the publication is stated to be "to furnish a rallying point where the humane may register those benevolent practical suggestions which are from time to time offered for correcting the evil—where acts of rational humanity may be recorded—where acts of atrocious cruelty may be held up to public execration—and where the grand principle of *prevention of cruelty*, by introducing an *improved* system, may be clearly developed to the legislature and the public." From the numbers of the work which are now before us—five in all—we are happy to be able to say, that it is fulfilling all these purposes with great spirit and ability. The chief subjects which have hitherto occupied its pages are the bull-baits, still so common in many of our manufacturing districts—that monstrous nuisance, Smithfield Market—and the horrid barbarities of the slaughter-houses and knackers' yards of the metropolis. The new modes of practice suggested, are conceived in general, in a very discreet and practical spirit; and we make no doubt we shall see, ere long, not a few of them universally adopted. We quote from the last Number, the following improvement in the present revolting mode of conveying sucking-calves to market; it is very simple; and likely to be also very efficient:—

> "Place a layer of straw at the bottom of any cart (except the cart at present used for the purpose), and bore equidistant holes in the sides of the cart to receive the end of a halter. The sucking-calves are each to have a halter on the head, as in the dairy-house; and when placed in the cart, the end of the halter is to be passed through the hole in the side, so as to regulate the length, that each calf may be at liberty to stand up or to lie down, without getting over the sides of the cart or overlaying each other. The only additional appendage required to render this still more complete is a tail-board to the cart, which should be so contrived as to form an inclined plane when touching the ground, with strips of wood nailed across it about six inches apart, down which the calves could be easily led by their halters."

A book is opened at the shop of the publisher of the "Voice of Humanity," (Mr. Nisbet, Berners-street), for receiving subscriptions to the Association. We regret to observe, that the amount subscribed is as yet inconsiderable; and that the first year's balance-sheet of the Society shows an excess of expenditure beyond the receipts of £36. 11*d.* Let us hope that next audit-day will exhibit a very different result.

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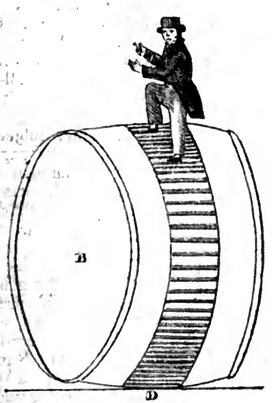
* The Voice of Humanity, published quarterly, for the Association for Promoting Rational Humanity towards the Animal Creation.

THE PRINCIPLES OF LOCOMOTION.

SAXULA'S REPLY TO TREBOR VALENTINE.

F. 1.



Sir,—Although your correspondent, Trebor Valentine, (No. 416, p. 342), may not belong to the scientific class whose notice of my theory of locomotion I court, but who are certainly shy of pronouncing upon its merits,* yet I am glad to see even his remarks, as I have approved his opinions on many previous occasions; and it enables me to perceive the views of thinking men respecting it, and note those which are regarded as its weak points.

1st. I certainly have often spoken of long cranks, but I have also said other equivalent machinery; when I mention long cranks or levers, it is by way of illustrating the *best principles* of action, not the best practical modes. A cylinder 5½ feet long, simply working a crank, could not well be tolerated, and would only produce one rate of speed, or 4 miles an hour. Variable spur or endless-chain gear is intended to be used, so as to produce different speeds according to the nature of the road; and 4 miles an hour is, I think, pretty sufficient up a steep and bad turnpike-road, and it is there only where I reckon the longest leverage will be wanted.

2nd. He says speed is indispensable; so it may be; but I do not, nor ever did, pretend to provide it without a corresponding loss of power. I only attempt to show how a certain weight may be taken by a certain power over rough ground as well as smooth; but it must necessarily be at various speeds in proportion to the hindrances. A swift carriage is of little use on a turnpike-road, if it must stop at the first steep and rough hill that it comes to, and cannot ascend it at even the slowest rate, although the carriage may bear a steam power sufficient for the purpose ten times over if scientifically applied. My theory teaches to apply that power to a long lever (whether crank or wheel) on such an emergency, and gives the reason why it will succeed. Will T. V. give me the reason why the powerful vehicles at Liverpool cannot start over a 1½-inch bar? Can he give a better reason than my theory gives?

3rd. I cannot well reply to his third objection without going over the ground already travelled. I fear he has not studied the attempted proof of my 5th proposition at p. 152. The thing is new, and at variance with many *preconceived* ideas, and cannot be appreciated at a glance. I query whether our worthy Editor, willing to do justice, dare (excuse the word, 'tis no challenge) pronounce upon my theory, with the mere reading he has given it; if he dare, let him speak out, but give his reason, "not on compulsion,"

"Though reasons grew as thick as blackberries."

J. V. cannot, surely, think me so negligent as to have overlooked the obvious fact of the weight increasing the load. When a carter treads upon a spoke of his wheel to assist his overloaded horse, he may not *think* of the extra weight, but he *knows* he assists traction much more than will countervail the resistance of his own weight. 200lbs. may propel 2200lbs.; add another 200lbs. to the propulsive power, and it will be doubled, whilst the load is only increased $\frac{1}{11}$ part.

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* Saxula, when he wrote this, had not seen the able paper by Mr. Cheverton, which appeared in our last Number.—Ed. M. M.

But I do not give weight as the actual power of a steam-engine, but only as a simple measure of that power; surely weight will indicate the force of any mechanical power whatever. He does not take a right view of the subject; locomotion is not in his line, and if my explanation, in p. 152, do not convince him, he must please to wait the result of experiments, which I hope some person besides myself will be induced to make ere long.

4th. If my diagram, p. 248, be not an answer to his 4th objection, I cannot readily frame one that he will understand, because his ideas are not trained to locomotion; there is too much common motion hangs about them. In his note respecting the light-boat, I conceive the weight of his body operating on the end of an angular substance in a fluid medium, caused a tendency to three motions at least in that substance (the boat); but the prevailing motion would be in the line of least resistance, which would be up the inclined watery plane towards the most elevated part of the boat. A piece of wood in water slips from under the finger in a similar direction, when pressed at either end. T. V. squeezes me too close when he requires me to name the order of a lever, where none *apparently* is used. If he will show the lever, I will tell him the order and the place of the fulcrum.

I wonder Trebor Valentine, who knows better, should say that locomotion, or any operation of machinery, is "adventitious." That which can be performed 1000 times alike cannot be adventitious, or by chance. This remark shows the straits my opponents are driven to, to prove that theory false which it is plain they do not understand; for, if they understood it, they would all agree, as in a known mechanical or mathematical truth, in pointing out one true cause of error.

In the "famous wheel-barrow problem" power is gained, as it is in all other machines, by losing speed. The power by moving 9 inches, effects what it could not effect by moving only 2¼ inches.

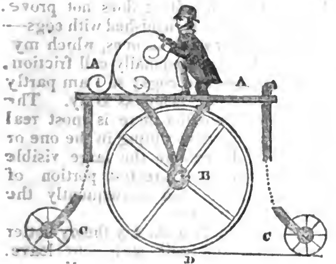
His remark about my note on friction, scarcely merits a reply. It was true enough, though the selection of an instance was not the most happy, being the only one I could find at the needful moment. The following, from vol. 13, page 168, is perhaps a better. "It has been generally admitted," "that the reduction of friction (on the rails) is the grand desideratum in railway conveyance." Resistance, as T. V. says, is the thing meant, but *friction* is the term used, and justifies my observation. My theory pleads for, if it does not prove, that all railways are furnished with cogs—either irregular *invisible* ones, which myself and others occasionally call friction, or regular apparent cogs; so I am partly a disciple of Mr. Thomas Gray. The question is—whether there is most real friction or abrasive sliding in the one or the other? I presume the large visible cogs present the greatest portion of sliding surface, and consequently the greatest real friction.

I would gladly make my theory better understood, and will, with your leave, try another mode, by which T. V. must, I think, own that a locomotive machine may be, in principle, a "simple lever with its fulcrum on the road." Let Trebor Valentine consider how he would sit or stand upon a common roller or barrel as B, fig. 1, having *no axle or centre fulcrum*, and how he would roll it along, without his touching the ground, and he will then have in principle, a rude locomotive machine of the simplest order, without any friction at all (except the friction of my invisible cogs, above named) the resistance and power being in their best places, or nearly so.

The larger the roller the greater the leverage, and more easy to propel. He would propel it were he inside or out, by treading upon or weighing one side more than the other. Calling this a machine, the ground and its obstacles at D, would surely be allowed to be the locomotive fulcrum. Where else could it be? The man's weight would represent the power and part of the resistance, and one side of the roller would represent a lever to lift the other side. The roller now revolves upon an imaginary centre, and goes forward without friction; the difficulty of working this rude carriage would consist in continually scrambling up the descending side, but by a little addition, and without altering the main principle, the machine may be made more commodious to work. Let a real centre be put to the roller, as in Fig. 2, and in this real centre bear a frame

AA, to support the power, or the man, from which he can apply part of his weight, or muscular force, to turn the roller B as before, having now, in addition, the axle friction to overcome.

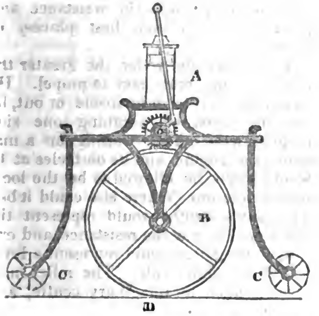
Fig. 2.



Here another difficulty would arise in keeping the frame balanced on the centre. To do this, put a few small wheels, CC, to support the frame in equilibrio, as nearly as possible, which will still add more weight and friction without altering the main principle, for the roller is supposed to carry the whole.

Lastly, as a substitute for the man, put a steam-engine, A, Fig. 3.

Fig. 3



The force of this steam-engine shall be applied on the rim of the roller, or where the man applied his power, and you have, *in principle*, a perfect Triumph steam-carriage, at a maximum of power and minimum of speed. The roller B carrying the whole, when the frame is exactly balanced, and if a hundred common motion fulcrums (*Anglicé*,) be at work amongst themselves on the roller, they do not change the original locomotive fulcrum at D. Here we have the main weight of the roller and frame just over the fulcrum at D, and the power applied to the longest possible lever, which I maintain gives the *ne plus ultra* of locomotive effect. See my theory.

Yours, &c.

SAXULA.

August 6, 1831.

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A WORD TO SAXULA ON LONG CRANKS.

Sir,—I have always been taught to consider that long cranks were to be preferred only because they were the consequence of a long stroke in engines, which, I believe, every one approves to a certain extent. Let us suppose a steam-carriage with wheels 54 inches diameter, and that, sacrificing speed to power, we were to drive the crank-shaft, independent of the carriage-wheel; suppose, further, that on this shaft there were placed a toothed-wheel of 18 inches diameter, representing the length of the stroke of the engine, and that with this wheel we were to drive another toothed-wheel, fixed to the axle of the carriage, of 53 inches in diameter (or so as just to clear the road, or to represent Saxula's long crank). Does Saxula think we should do more work with the same power than as at present applied? If so, he is grievously mistaken. Again, if these wheels would make a difference, so would a band from the crank-shaft to another drum on the axle; that on the crank-shaft 18 inches, on the axle 53 inches.

Yours, &c. QUID.

◆

INCLINED PLANES IN CANALLING.

Sir,—It is asserted in the American account of certain experiments on the Morris Canal, (inserted in the Mechanics' Magazine, vol. xv. p. 204), that 5 boats, of 25 tons each, can be passed up an inclined plane, of 70 feet rise, in the space of an hour. It is likewise said, that the detention on each boat is at the rate of 1 minute on each 10 feet of lift; which is affirmed to be a saving of at least 9-10ths, as compared with locks.

Now, on the Forth and Clyde Canal

vessels of 100 tons pass the locks of 8 feet rise in from 2½ to 4 minutes, according as the persons in attendance at the sluices and gates are active or otherwise. It is therefore evident, that in locks of certain dimensions a greater tonnage may be passed per hour than by an inclined plane like that described; and there can be little doubt that when saving of time becomes an important object, the locks of small canals may be filled or emptied, and vessels passed up or down in one minute.

Yours, &c. J. R.

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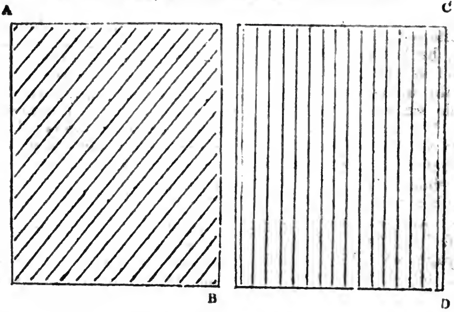
ON PLANTING, LENGTHWISE AND DIAGONALLY.



Sir,—Your correspondent, S. B., page 89, is quite mistaken in fancying that diagonal are more advantageous than lateral lines in planting, sowing, &c. On reference to his own figure he will perceive that he has allowed the diagonal lines to extend to the limits of the land on all the four sides, whilst the other lines are placed full 4 inches within the limits on two of the sides. But to compare the two cases properly, the extreme lateral lines should be only 2 inches within the limits, which would then include one more line of 5 feet, and consequently just balance the total of the diagonals.

I would propose a fairer case still, which, I trust, will show S. B. that the lateral method has, in reality, the advantage.

Let AB and CD be two equal rectangles; and having decided what margin is necessary on all the sides, draw the two inner rectangles, which, for the sake of whole numbers, we will presume 80 inches long and 60 wide, and also that the direct distance between the lines shall be 4 inches. Now, in the first piece, the greatest line or diagonal is 100 inches, and on each side of this, there is a series of 11 lines of 8⅓, 16⅔, 25, &c. The sum of each series is, therefore, 550, and the total of all the diagonal lines is exactly 1200. In the second piece, the lines are evidently 16 of 80 long, amounting to 1280; hence there will be always one line in favour of the lateral method. It may be remarked, that if the lines were taken across the field, the advantage would be only one line of 60; therefore it is best to drill lengthwise, according to the general method of agriculturists, subject, of course, to a moderate length of the furlong.

Yours, &c.

W. D. SNOOKE.

Ryde, June 6, 1831.

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NEGRO COLONY OF LIBERIA.

Elliott Cresson presents his thanks to the Editor of the Mechanics' Magazine for the kind notice taken of Liberia in his last Number (418); and to enable him to judge whether the statements 'have been too highly coloured,' begs his acceptance of the accompanying Reports: referring him particularly to pp. 29—33, for the evidence of the colonists themselves.

8 *Mo.* 18, 1831.

Mr. Cresson is the Agent of the American Colonization Society, to whom allusion was made by the writer of the notice, which appeared in our pages, as being, "now in London, and ready to receive the subscriptions of English admirers of the plan." We have perused the Reports with which he has favoured us, and have great satisfaction in acknowledging that they establish, beyond every suspicion of "high colouring," the accuracy of the statements in question. Mr. Cresson solicits not our subscriptions for private ends; he has come amongst us on a mission of as pure philanthropy as ever warmed the human breast; and most cordially do we wish him every possible success. We shall extract part of the evidence to which Mr. Cresson has referred us; but before doing so, it seems proper that we should lay before our readers some further account of the excellent Society, of which he is the representative. We feel the more induced to do so, that our pages have been heretofore (vol. xv. pp. 109—116) the medium of much severe reflection on the Americans, for the protracted existence of slavery amongst them, without any notice being taken of the many redeeming circumstances, which the history of this Society discloses, and of some of which we must candidly confess we were not aware. The following particulars we extract from an "Introduction" by Mr. Cresson to the Reports which he has sent us:—

"Slavery, and its inconsistency with the dictates of Christianity, have long been freely acknowledged and deeply lamented by the people of the United States—and its removal, the great problem which has occupied the attention of her best and wisest men. So far back as 1698, the Assembly of Pennsylvania, to put an end to the introduction of slaves, laid a duty of £10 per head upon their importation; but this benevolent law, together with about *fifty* of similar tenor, which were passed by the neighbouring colonies up to the period of their Revolution, *were all refused the sanction of the mother country*. The introduction of slaves was one of the great causes of complaint, which led to their Declaration of Independence, dated July 4th, 1776.

"Scarcely had that struggle ceased, when a colony on the coast of Africa, similar to that of Liberia, was proposed, but the prosecution of the Slave Trade, by every civilized Power, defeated these benevolent views. In 1796, the plan was again revived, in a series of luminous essays by Gerard T. Hopkins, a distinguished friend in Baltimore; and shortly afterwards the Legislature of Virginia, a State containing nearly one-third of the black population of the Union, pledged its faith to give up all their slaves, provided the United States could obtain a proper asylum for them. President Jefferson negociated in vain for a territory either in Africa or Brazil; but that great State (Virginia) again renewed its pledge in 1816, by a vote of 190 to 9, (most of the Members being slave-holders,) upon which, Gen. C. F. Mercer, the Wilberforce of the American Congress, opened a correspondence with the philanthropists of the different States, which led to the formation of the AMERICAN COLONIZATION SOCIETY, on the 1st of Jan. 1817.

"The great objects of that Society were—the final and entire abolition of slavery, providing for the best interests of the blacks, by establishing them in independence upon the coast of Africa; thus constituting them the protectors of the unfortunate natives against the inhuman ravages of the slaver, and seeking, through them, to spread the lights of civilization and Christianity among the *fifty millions* who inhabit those dark regions. To meet the views of all parties, they had a most difficult part to tread; but as all legislation on the subject of slavery was *specially reserved to the respective States by the Articles of Confederation, and had become the basis of the Constitution of the United States*, they very wisely, instead of denouncing an evil which they had not the power to overthrow, had recourse to the more sure, but gradual mode of removing it, by enlightening the consciences, and convincing the judgments, of the slave-holders. Their theory is justified by experience; for while our little colony has grown quite as fast as could be wished for by its most judicious friends, these principles have been silently gaining ground in the slave States, yet so rapidly, that the number of slaves offered gratuitously by benevolent owners, exceed ten-fold the present means of the Society to receive and convey them to Africa. The disposition of Virginia has been already shown. Delaware and Kentucky have also proved their anxiety to concur in so noble a cause; and Dr. Ayres, the earliest Governor of Liberia, now a resident of Maryland, asserts, "that owing to the plans and principles of colonization being better understood, in less than twenty years *there will be no more slaves born in that State*. A party in South Carolina is now almost the only opponent that the Society has at home; and, as if to afford the most incontestable evidence that its plan will destroy the institution of slavery in the United States, they ground their opposition upon the *inevitable tendency* of colonization *to eradicate slave-holding*, and thereby deprive them of their *property*."

After detailing what the Society have accomplished at Liberia, and which we need not repeat, Mr. Cresson proceeds:—

> "All this has been effected for the small sum of £27,000; and its friends, at first but few, have so increased, in number and confidence, that one-third of their total receipts accrued during the last year. Several religious bodies have given it their earnest and unanimous support—thirteen of the States have recommended it to the patronage of Congress; and on the elevation of its champion, the Hon. Henry Clay, to the Presidency, there cannot be a doubt that funds adequate to the fulfilment of this glorious design will be granted by the General Government."

It may be asked, what pressing occasion there is for transportation to Africa? Cannot emancipated blacks thrive as well in the United States—of which most of them are natives—as in this new settlement of Liberia? The following extracts from an Address of Mr. Clay to the Colonization Society of Kentucky, will furnish satisfactory answers to both these questions:—

> "Of all the descriptions of our population, and of either portion of the African race, the *free* people of colour are by far, as a class, the most corrupt, depraved, and abandoned. There are many honourable exceptions among them, and I take pleasure in bearing testimony to some I know. It is not so much their fault as the consequence of their anomalous condition. Place ourselves, place any men in the like predicament, and similar effects would follow. They are not slaves, and yet they are not free. The laws, it is true, proclaim them free; but prejudices, more powerful than any laws, deny them the privileges of freemen. They occupy a middle station between the free white population and the slaves of the United States; and the tendency of their habits is to corrupt both. They crowd our large cities, where those who will work can best procure suitable employment, and where those who addict themselves to vice can best practice and conceal their crimes. If the vicious habits and propensities of this class were not known to every man of attentive observation, they would be demonstrated by the unerring test of the census. According to the last enumeration of the inhabitants of the United States it appeared, that the rate of its annual increase was only about two-and-a-half per cent., whilst that of the other classes was about three. No other adequate cause for this disproportion can be assigned, but that of the improvidence and vices of the class referred to.
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> "The vices of the free blacks do not spring from any inherent depravity in their natural constitution, but from their unfortunate situation. Social intercourse is a want which we are prompted to gratify by all the properties of our nature. And as they cannot obtain it in the better circles of society, nor always among themselves, they resort to slaves, and to the most debased and worthless of the whites. Corruption, and all the train of petty offences, are the consequences. Proprietors of slaves, in whose neighbourhood any free coloured family is situated, know how infectious and pernicious this intercourse is. And the penal records of the tribunals, especially in the large cities, bear frightful testimony to the disproportionate number of crimes committed by the free people of colour."

For the beneficial change effected in the character and fortunes of these people by transplanting them to Africa, we shall now quote that "evidence of the colonists themselves," to which Mr. Cresson has directed our attention. The passages which follow are extracted from a circular address of the colonists of Liberia to their free brethren of colour in the United States; agreed to at a public meeting held at the Court House of Monrovia (the chief town of Liberia) on the 29th August, 1827.

> "The first consideration which caused our voluntary removal to this country, and the object which we still regard with the deepest concern, is liberty—liberty, in the sober, simple, but complete sense of the word; not a licentious liberty, nor a liberty without government, or which should place us without the restraint of salutary laws—but that liberty of speech, action, and conscience, which distinguishes the free enfranchised citizens of a free state. We did not enjoy that freedom in our native country; and, from causes, which, as respects ourselves, we shall soon forget for ever, we were certain it was not there attainable for ourselves or our children.—This, then, being the first object of our

pursuit in coming to Africa,' is probably the first object on which you will ask for information. And we must truly declare to you, that our expectations and hopes, in this respect, have been realized. Our constitution secures to us, so far as our condition allows, "all the rights and privileges enjoyed by the citizens of the United States;" and these rights and privileges are ours. We are proprietors of the soil we live on, and possess the rights of freeholders. Our suffrages, and, what is of more importance, our sentiments and our opinions have their due weight in the government we live under. Our laws are altogether our own; they grow out of our circumstances; are framed for our exclusive benefit, and administered either by officers of our own appointment, or such as possess our confidence. We have a judiciary, chosen from among ourselves; we serve as jurors in the trial of others; and are liable to be tried only by juries of our fellow citizens, ourselves. We have all that is meant by *liberty of conscience.* The time and mode of worshipping God, as prescribed to us in his word, and dictated by our conscience, we are not only free to follow, but are protected in following.

"Forming a community of our own, in the land of our forefathers; having the commerce, the soil, and resources of the country at our disposal, we know nothing of that debasing inferiority with which our very colour stamped us in America; there is nothing here to create a feeling on our part—nothing to cherish the feeling of superiority in the minds of foreigners who visit us. It is this moral emancipation—this liberation of the mind from worse than iron fetters—that repays us, ten thousand times over, for all that it has cost us, and makes us grateful to God and our American patrons for the happy change which has taken place in our situation. We are not so self-complacent as to rest satisfied with our improvement, either as regards our minds or our circumstances. We do not expect to remain stationary. Far from it. But we certainly feel ourselves, for the first time, in a state to improve either to any purpose. *The burthen is gone from our shoulders: we now breathe and move freely.*

* * * *

"Truly, we have a goodly heritage; and if there is any thing lacking in the character or condition of the people of this Colony, it never can be charged to the account of the country; it must be the fruit of our own mismanagement, or slothfulness, or vices. But from these evils we confide in Him, to whom we are indebted for all our blessings, to preserve us. It is the topic of our weekly and daily thanksgiving to Almighty God, both in public and in private, and He knows with what sincerity, that we were ever conducted, by his Providence to this shore. Such great favours, in so short a time, and mixed with so few trials, are to be ascribed to nothing but His special blessing.—This we acknowledge. We only want the gratitude which such signal favours call for. Nor are we willing to close this paper without adding a heartfelt testimonial of the deep obligations we owe to our American patrons and best earthly benefactors, whose wisdom pointed us to this home of our nation, and whose active and persevering benevolence enabled us to reach it.

* * * *

"We solicit none of you to emigrate to this country; for, we know not who among you prefers rational independence, and the honest respect of his fellow men, to that mental sloth and careless poverty which you already possess, and your children will inherit after you, in America. But if your views and aspirations rise a degree higher—if your minds are not as servile as your present condition—we can decide the question at once; and with confidence say, that you will bless the day, and your children after you, when you determined to become citizens of Liberia.

* * * *

We have confined ourselves, in the preceding extracts, to such passages as best testify how the colonists themselves think and feel under the change which has taken place in their circumstances; and truly, a more wonderful regeneration of character has seldom, if ever, fallen under our observation.

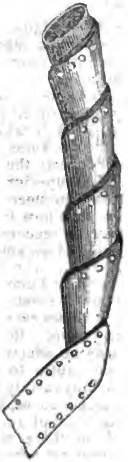
We might also quote from this Address many interesting particulars respecting the products of the country, and the progress made by the settlers in farming, building, &c., but it may suffice to mention generally, that the evidence of the colonists fully corroborates all that was stated on these heads in our first notice of the colony.

We will now only add, that to persons of practical benevolence—to those who have, at once, the will and the power to do good—a more inviting opportunity of exertion can scarcely be imagined, than that which is now offered by this colony of Liberia. The experience of the American Colonization Society shows, that for a sum of 7*l.* 10*s.* you may "not only secure the freedom of a slave, and pay his passage to Africa, but constitute him a freeholder of thirty acres of fertile land." Think of this, ye affluent—only think at how small price so sweet a gratification as that of giving freedom and independence to a fellow being can be obtained—and refuse your mite if you can.

Mr. Cresson's address is No. 19, Adam-street, Adelphi.

FIRE-ENGINE SUCTION-PIPES.

Sir,—In some towns in Belgium, the suction-hose of the fire-engines are made without any internal metal spiral to support them against the pressure of the atmosphere. They are formed, in the manner represented in the following sketch, by winding a broad leather strap round a mandril in a spiral direction, overlapping sufficiently at each coil to allow of a line of copper rivets being inserted.

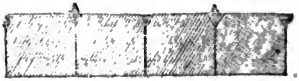


When the rivets are set very close, and the coils are not above 2 inches broad, such hose appear to have sufficient stiffness to answer the purpose intended, and to possess some advantages over those generally used in England.

Yours, &c. J. R.

REMARKS ON MR. BADDELEY'S "HINTS FOR IMPROVING STREET-PAVING."

Sir,—In No. 414 of your work, Mr. W. Baddeley proposes to "bevel the upper edges of the stones," to obviate the difficulty which horses experience in travelling the modern roads of the metropolis; he thinks such alteration would prevent them from stumbling and falling, assist them in ascending acclivities, and help them on level ground in frosty weather. But is it certain that more horses fall now than formerly? Although more may fall through the smoothness of the new paving, yet none fall through such roughness as distinguished the old roads. Besides, in a very few weeks after the stones are laid, in the new way, the fissures widen, and furnish quite sufficient abutment for the thrust of horses. I am inclined to think that Mr. Baddeley's plan would prove not only useless, but in frosty weather dangerous; for there is very little doubt but that the openings A (see the sketch subjoined) would become filled with frozen earth and water, which would render equestrian progress more difficult and dangerous than is at present the case.



In my opinion the new mode of road making is far more beautiful and durable than the old manner, and excepting the iron gutters, more pleasant and useful. The iron gutters, as Mr. B. observes, are certainly too smooth, and very serious accidents have occurred in consequence. Not many days since, a horse slipped its foot from stepping on one of these gutters in Coleman-street, and in the fall, the gentleman who rode it got his leg broken.

The risk of such mischances would be entirely avoided by adopting the excellent plan of stone gutters followed in the New London Bridge.

Yours, &c. J. B.

THE SIN OF OPPRESSION IN ITS RELATION TO MASTERS AND WORKMEN.

In the third volume (just published) of the Works of the late Rev. Robert Hall,* containing his various tracts on politics and political economy, there are two papers, written by him in 1819 and 1821, in defence of the Leicester Frame-Work Knitters' Fund, with which we have been particularly pleased, for the humane and enlightened views which they contain on the difficult subject of regulating wages. That every reduction in the wages of the working classes must be caused by a proportional falling off in the demand for the products of their industry, is one of the doctrines of the fashionable—that is the aristocratical—school of political economy; but that it is a very false doctrine, is, we think, demonstrated by Mr. H., with great clearness, in the following passage:

"That wages should decline to a certain extent along with the demand, is the natural consequence of the vicissitudes of trade; still it is but equitable that they should bear some proportion to each other. We will suppose, out of 10 000 hands engaged in this manufacture, that 1000 are out of employ; here, supposing the remainder to labour with only their usual degree of assiduity, there are nine-tenths of the manufacture produced which was made when they were all at work. The probable demand has diminished one-tenth. But if the effect of this is to reduce the wages nearly one-half, so as to place the necessaries of life out of the reach of the workmen, is not this a result to be deplored? and if any means, consistent with the peace of society, can be contrived to prevent it, ought they not to be adopted? In this case it is in vain to allege that the depression in question is rendered necessary in consequence of the decreased demand, because they bear no proportion one to the other. The demand is by the supposition diminished one-tenth —the wages are reduced nearly one-third. Such was the exact state of things at the late turn-out in Leicestershire. A proportion of about one in ten were unemployed, and this surplus of labour was converted, by a process not very creditable to the humanity of its authors, into an instrument of universal depression, to the extent already stated. The method by which it was accomplished is extremely simple. Those who were out of employ were driven, by the distress of their situation, to offer their services on terms the most disadvantageous; the offer was accepted; and this afforded a pretext for gradually lowering the wages of the rest, who had no alternative but to submit to the abatement proposed, or quit their employ. Further reductions were imposed, which, for the same reason, were, for the most part, submitted to; till, through a few successive stages, the wages of all were brought to the same level. —Thus the wretched workmen were reduced to the necessity of acquiescing, not in that abatement of wages which was proportioned to the diminished demand, but in the terms which a small minority were induced to accept; and the destitution and despair of a few became the gauge by which the miseries of all were measured out. If there is a man to be found who is perfectly reconciled to such a procedure, who sees nothing in it inconsistent with the dictates of the most refined and enlightened humanity, his mental structure is such as I shall never envy."

Mr. Hall here traces the evil to its true source—an extortionate spirit on the part of employers; and to them, as its culpable authors, he afterwards addresses himself in the following indignant strain:

"Before I conclude, let me be permitted to remind the reader that there is such a sin as oppression; that it consists not in that gross violation of justice which is cognizable by law, and against which the wisdom of all civilized nations has provided; but in taking such an advantage of the weakness and necessity of the poor as converts them into mere instruments of a superior power, the victims of selfish emolument, with no other consideration than how far their physical exertions may be rendered subservient to the gratification of an unfeeling rapacity. He is the oppressor who is not restrained by the dictates of humanity from pushing, to its utmost extent, the natural superiority which riches every where possess over poverty; and the stratagems by which this may be effected are too numerous and too subtle to fall within the cognizance of any earthly tribunal. When the Scripture denounces, with such awful severity, the doom of such as "withhold their hire from those who reaped the field," we must not suppose it refers so much to a violation of compact, an offence which the laws of no civilized country would permit, as to the *inadequacy* of the recompense itself. In the eye of heaven, wages may justly be said to be *withheld* from the labourer, when they are totally inadequate to his subsistence, and such as nothing but helpless indigence could induce him to accept."

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* Now in the course of publication under the able superintendence of Dr. Olinthus Gregory.

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STAINS FROM THE BRASS WIRES OF THREAD-BUTTONS.

Sir,—Perhaps some of your chemical friends will furnish me with an explanation of the following circumstance. Thread-buttons, the wires of which are of brass, were sewn on a shirt of Irish linen; the shirt, with the buttons, was washed by a laundress in the ordinary way. Upon drying, it was found that the solder by which the brass rims are fastened had oxidated, and communicated to the thread of the button, and every part of the linen shirt with which it came in contact, a permanent stain similar to that produced by lunar caustic upon the skin. I have no convenience for making experiments to ascertain the cause of this, and my theoretical knowledge of chemistry does not assist me. The circumstance may be worth knowing to those connected with the button-manufacture; and I may have my curiosity satisfied if you will have the goodness to spare a corner for this inquiry.

Yours, &c.
A CONSTANT READER.

Aug. 20, 1831.

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LIST OF NEW PATENTS GRANTED, FROM THE 20TH OF JULY, TO THE 20TH OF AUGUST, 1831.

William Allen, of Catherine-street, Strand, pianoforte-maker, for certain improvements upon pianofortes. Two months to specify, July 20, 1831.

Lieutenant Henry Lister Maw, of South Molton-street, for an improved method of using fuel so as to burn smoke. Six months, July 20, 1831.

John Bance, of Moscow Cottages, Bayswater, gent. for an invention of an improvement in the construction of heads or hoods for cabriolets, gigs, and other open carriages, whereof the heads or hoods are required to fold down behind the back of the seat when out of use. Communicated by a foreigner residing abroad. Two months, July 27, 1831.

John Young, of Wolverhampton, locksmith, for certain improvements on locks and latches with regard to the security of the same, and the construction of the interior and exterior parts thereof. Six months, July 27, 1831.

Marmaduke Robinson, of Westminster, navy-agent, on behalf of Lieutenant William Augustus Archbald, R. N. at present residing at Louisiana, in the United States of America, for certain improvements in the making and purifying of sugars. Six months, July 27, 1831.

William Church, of Heywood House, Birmingham, for certain improvements in machinery for making nails. Six months, July 27, 1831.

Angier March Perkins, of Harper street, Middlesex, civil engineer, for certain improvements in the apparatus or method of heating air in buildings, heating and evaporating fluids, and heating metals. Six months, July 30, 1831:

Sir James Caleb Anderson, baronet, for certain improved machinery for propelling vessels on water, which machinery is applicable to other useful purposes. Six months, August 2, 1831.

John Hall, the younger, of Dartford, engineer, for an improvement in machinery used in the manufacture of paper; communicated by a foreigner residing abroad. Six months, August 3, 1831.

Jean Marie Etienne Ardit, of Newman-street, Middlesex, printer, for a machine or apparatus for drawing, and for copying and reducing drawing and other objects or subjects, and for taking panoramas. Communicated by a foreigner residing abroad. Two months, August 10, 1831.

Alexander Cochrane, of Norton-street, Middlesex, esquire, for certain improvements in machinery for propelling or moving locomotive carriages, and giving motion to mills and other machinery. Six months, August 10, 1831.

William Mason, of Margaret-street, Cavendish-square, patent axle-tree maker, for certain improvements in the construction of wheeled carriages. Six months, August 10, 1831.

David Selden, of Liverpool, merchant, for certain improvements in metallic mills for grinding coffee, corn, drugs, paints, and various other materials. Communicated by a foreigner residing abroad. Six months, August 11th, 1831.

Augustus Whiting Gillet, of Birmingham, merchant, for a new or improved machine or instrument to measure, beat, and give the accents in all the different moods of time, with any degree of velocity required applicable to the teaching of music. Communicated by a foreigner residing abroad. Six months, August 13, 1831.

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INTERIM NOTICES.

We had prepared for insertion in this Number, a digested report of the case of Cochrane and Galloway v. Braithwaite and Ericsson; but we find it occupies more room than we can spare this week. "Artificer" must, therefore, nurse his "impatience" for yet another eight days.

We recommend to "A Lady" to try a solution of chloride of lime, which may be had of any apothecary: and shall be glad to know whether it has the desired effect.

"A Constant Reader" may procure the instrument to which he alludes at Dollond's, or any other respectable optician's.

We shall endeavour to furnish Mr. Smith with the information he requests next week.

Communications received from: N. S. N.—Henry D. (of date, 21st March)—Mr. Baddeley—L. A. B.—J. W.—Mr. Dancer—Mercurius.

Errata in the Article on Commercial Science, No. 418, p. 382.—In the 2nd edition of *The Cambist*, the Chinese pecul is, with the sanction of the East India Company, *rightly* accounted = $133\frac{1}{3}$ pounds (not $133\frac{1}{4}$).

The Bazar seer is . . . 32 ounces.
The *liquid* chatack is 1-16 (not 1-18) = 2 ounces.
$\left.\begin{array}{l}\text{i. e. 2 Portuguese ounces}\\\text{or, 5 Bombay rupees}\end{array}\right\}\begin{array}{l}= \text{2,000 reas}\\\text{or, 2 mil-reas.}\end{array}$
The seer is 2 English pounds = 80 standard rupees.
2 seers = 3 Chinese pounds.

August 13, 1831. T.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine office-court, (between 145 and 146) Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 421.] SATURDAY, SEPTEMBER 3, 1831. [Price 3*d*.

BIRD CATCHER'S PORTABLE-HUT.

Fig. 1.

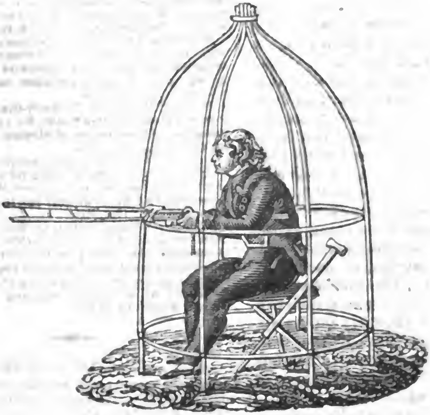
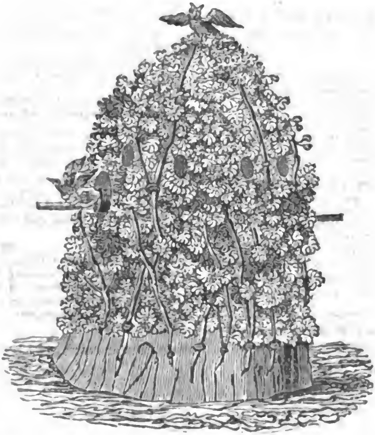


Fig. 2.



BIRD-CATCHER'S PORTABLE HUT.

(From the French.)

The Bird-Catcher's Portable Hut is generally formed of two large hoops placed horizontally and connected by four slender uprights. It is all covered by branches of trees, fresh cut, so as to resemble a bush as much as possible. The branches are to be long enough, and sufficiently covered with leaves, completely to conceal the bird-catcher. "In my youth," says the writer, "I was a great lover of this sort of sport, and had a very convenient hut. It was constructed of strong iron wire, and consisted of two circular parts, about five feet diameter, about seven feet long, bent in a circular form in their upper part, and attached each of them to a slender ring, about five inches diameter." (This frame is represented in Fig. 1, preceding page.) "It may be readily carried about, the uprights making only one rod when taken down and tied together. I did not make the hoops, however, all of one piece. I took six pieces of strong iron wire, each about two feet six inches long, and each made at both ends into a ring, and fastened together like a chain; but one of the extreme ends was fashioned into a hook, so that it could be easily attached to the ring at the end of the other piece. These six pieces, when united, formed a hexagonal figure, each side of which was the exact length of the space between the two uprights. Each of the uprights had two rings made of the same sort of wire, at the spots where the hoops were to be placed, and the rings were sufficiently large, to allow the chain hoops to pass through them. I always tied the hoops fast to the uprights. I covered the whole with a piece of light green cloth, which was fastened to the upper little circle, and in the outer part of this there were a number of loops, to which I could fasten a number of small branches of trees, full of leaf, so as entirely to cover the huts. About the height of the bird-catcher's eyes when seated, there were holes made in the green cloth, (see Fig. 2), so that I could see what was going on all around. There was also a hole, through which I could put my arm, to take the birds from the net, to withdraw the net, and whatever else was necessary."

ACTION FOR INFRINGEMENT OF PATENT.

LORD COCHRANE AND MR. ALEXANDER GALLOWAY V. MESSRS. BRAITHWAITE AND ERICSSON.

Tried before Lord TENTERDEN *and a Special Jury, July* 6, 1831.

Mr. FRED. POLLOCK, for the plaintiffs, stated that the question to be tried was, whether the plaintiffs had invented a certain machine, and whether the defendants had pirated that machine, in whole or in part? The plaintiffs claimed to have invented a new and most advantageous method of obtaining a great heat, free from the inconvenience hitherto attendant on all plans for this purpose, of much foul smoke. It was a method applicable to all cases where heat had to be generated, but was in a particular manner adapted to steam-engine boilers. There (pointing to the table) was a model of their machine; and here (exhibiting a paper) was a drawing of it. The Jury would observe, that there was the fire-place, (pointing it out[*]) and here the ash-hole; air was blown in above and below[†]; and the course of the air after it passed through the fire was in this manner (tracing the flue to its biforked extremity); after which it might take a course either up or down. The upward branch or pipe, (Y) however, was only open at first lighting the fire, and at all other times was kept closed and air-tight. The descending branch of the flue went in under a column of water, which might be varied in point of height; and the products of the combustion being thus made to pass through this water, were freed from all impurities. The purification of the smoke was not, however, the only advantage gained; for by the compression caused by the column of water much more heat was evolved than would otherwise be the case. As regarded this compression, the same effect might be produced by a weight of any sort on the valve which, it would be observed, was placed at the lower extremity of the flue. The tubes as they go along also became narrower,[‡] so that that also served to produce a greater degree of compression. It was well known that a fire burns more feebly at the top of a mountain than in a valley. What was the reason? It was because the air at the top is rarified, and the air at the bottom is comparatively dense. This showed that the more we condense air the fitter we make it for purposes of combustion. There was another illustration of this fact, familiar to every one acquainted with matters of this sort. If you put a bell in a receiver of an air-pump and strike the bell, or have an apparatus ready to strike it the moment you begin drawing out the air, it will be found that as you exhaust the air the sound becomes feebler and feebler till it ceases altogether to be heard. A person seeing this would naturally infer, that it is only necessary to admit the air again, that is, to re-condense the air in the receiver, to make the sound of the bell be again heard; and so it is—in proportion as the air is pumped back again the sound becomes louder and louder. It was not necessary to say how the condensation of the air produced such an effect; it was sufficient for the purpose in hand, that the fact was so, inasmuch as it furnished another striking illustration of the benefit of compression in promoting combustion.* Where air is rare and thin, fire is feeble; where it is condensed and thickened, fire is strong in proportion. Another advantage gained by keeping up the fire under this compression and condensation was obtained, namely, that the heat was generated and passed off more rapidly. It was not necessary to go into the philosophy of this effect; it was sufficient to appeal to the experience of the Jury themselves, who must have all observed that the fact is so. They all knew perfectly well, that when air and water are exposed to the same temperature, they become ultimately precisely of the same heat. A bottle of water that stands in a room is precisely of the same temperature as the air of that room; a thermometer introduced into it neither rises nor falls. However, if you put your hand instead of the thermometer into the bottle of water, you were sure to experience a sensation of great coldness. Or, suppose there were a bath in the room, you might strip yourself and be exposed to the air without feeling cold; but the moment you plunged into the water, you would experience a sudden chill, and be induced in a short time to get out again. What was the reason of this? Whether it was that the water touched you in more points than the air, from its being more condensed, it was unnecessary to say; the fact of the difference of sensation was certain, and with that alone he (the Learned Counsel) had to deal. This much was quite evident, that the more you compressed and condensed air, the more you made it resemble water, and the more rapidly it would part with its heat. The minds of the Jury would, no doubt, furnish them with many instances in which effects of a like sort were produced. When a person lays his hand on flannel or on down, it feels warm. Why was this? Because it instantly reflects back the heat of the hand, or rather it will not take it away. But lay the same hand on a slab of marble, and you have the sensation of extreme cold. Yet, if a thermometer were applied to the two substances, it would be found that they were both of the same temperature. Again, suppose that both the marble and the flannel were heated to 200° Fahrenheit; you might lay your hand with perfect safety on the flannel, but not on the marble without danger. There was one other remarkable instance—it was that of an eminent, it might be said an illustrious individual, Sir Joseph Banks—who actually remained in an oven heated to 300°, for a considerable time, with two or three other persons, and that with perfect impunity. Why? Because they were surrounded by air of extreme rarity. But how long did the Jury think they would have lived in a more condensed atmosphere? Why, if the condensation had been increased till the air became fluid, they would have been boiled! The Gentlemen of the Jury would see from all this* what was the object of having the stove as nearly as possible air-tight. You had here a grate which let in no air; you had a bellows entirely under your controul; you had a pressure produced by this gradually narrowing channel;† you had a valve here and a stopper there, capable of being opened or shut, or more or less opened; you had a valve, too, capable of being closed with a weight, or a column of water to resist the escape of the air, which you might increase to any extent you might think fit. The Gentlemen of the Jury might naturally be induced to ask, "But how do you supply this air-tight

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[*] To enable the reader to accompany the Learned Counsel in his explanations, it will be necessary that he refer to our 389th Number, where he will find two engravings—one of the plaintiffs' machine as originally patented, and another of their machine as altered within the last twelve or eighteen months. It was a drawing of the latter which Mr. Pollock exhibited—with what fairness it is unnecessary to state.—ED. M. M.

[†] According to the plaintiffs' *specification*, the air was only to be blown in at the bottom; the introduction of it at top was an after-thought. See Mech. Mag. No. 389, p. 364.—ED. M. M.

[‡] In the machine as actually patented there was no such narrowing of the tubes. The plaintiffs did latterly adopt this mode of construction, but not till

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after they had seen it adopted by the defendants.—ED. M. M.

* We presume it must be the fault of the short-hand writer that this looks so much like confounded nonsense. The two cases have no earthly analogy. —*ED. M. M.*

* Clever Jurymen, if they could. What bearing any of these instances has on the case in hand, we have been quite puzzled to comprehend.—ED. M. M.

† A thing never dreamt of by the plaintiffs when they took out their patent. See preceding note.—ED. M. M.

stove with fuel? In a common furnace the door is opened and the fuel thrown in; but were you to open the door of such a furnace as this of the plaintiffs, where all the included materials are under so high a state of compression, the consequence would be, that smoke, fire, and fuel would rush forth in one confused volume, with all the force of an explosion. Now, the plaintiffs had invented a mode of feeding their furnace *without opening the door.* It was a most ingenious device; and he (Mr. P.) believed that until the plaintiffs obtained their patent it had never been communicated to the world, and never put in practice. The Jury would observe, that immediately over the burning fuel there rises a pillar, or column, or cylinder—call it which you will—and which may be either square or round. Well, this cylinder is divided by a valve which turns on its centre; the coals are thrown in; the valve turns up; and down the coals go into the fire. But it may be said, what then? What provision is made for a repetition of the process? Why, connected with the valve there is an apparatus for opening and shutting it at pleasure; no sooner is the coal let down, than the valve is again closed; and at the top of all there is an air-tight cover which excludes the external air, while this operation of opening and shutting the valves is going on. It was an operation which might be performed not merely every quarter of an hour, but every five minutes—indeed, every half minute; it might be done, in short, without intermission, and without in the slightest degree disturbing the fire or producing any bad effects; you had nothing to do but to open this (the cover), put in the fuel, then shut up the cover and turn the valve, when away all would go. After this you had but to shut the valve, and all was as before. In fact, there was a chamber, which you might cause to communicate either with the fire-place or with the air—just as you pleased.

A Juror. Will you allow me to ask, is that explained by the model?[*]

Mr. POLLOCK replied that it was, and proceeded to show from the model the manner of the operation. What had suggested this ingenious contrivance he would not say, but it seemed exactly like the mode in which the piston of a steam-engine is made to operate by the alternate influence of a vacuum and plenum. The learned Counsel next adverted to the application of the heat when produced in the way he had explained. The drawing represented the furnace and the flues as surrounded with water: but all that was intended by that was, to show that if you incased the apparatus with a boiler, the heat would pass to the water and cause it to boil with great fierceness; and that the boiling temperature of that water could be kept up either for the purpose of supplying a steam-engine, or for any other purpose for which boiling water might be wanted. It was a matter of indifference, however, to Lord Cochrane and Mr. Galloway whether their apparatus was used for steam-engines or to heat large apartments, or for culinary purposes; and it was accordingly described in the specification as being capable of such general application. The Jury having been now put in full possession of the nature of the plaintiffs' invention, the Learned Counsel said he had next to direct their attention to what the defendants called *their* invention. Here it was (exhibiting a drawing[*]). This was the fire-place, supplied with cold air by an apparatus—a bellows—the air came in above and below; and when heated it passed away through a long tube, which became narrower and narrower, so as to make it more and more difficult for the air to escape. The apparatus was surrounded with water, for the purpose of making it a boiler. It was fed with fuel, not by a throttle-valve, but by a little chamber, which was capable of being opened and shut by means of sliders. Now, he (Mr. P.) would ask the Jury whether this little chamber, opening and shutting by means of sliders, was not in effect the plaintiffs' throttle-valve? And whether the long diminishing flue was not the same as the plaintiffs'? And whether the plan of feeding the fire, without allowing any communication with the external atmosphere, was not the plaintiffs' plan? The defendants, it was true, had made their fuel-chamber smaller than that of the plaintiffs, and square instead of circular; they had made their flue round instead of flat, and caused it to go out at the top instead of at the bottom: but these were immaterial variations, merely contrived to present to the inexperienced eye an apparent distinction, a colourable difference. The two inventions were substantially identical—for all practical and useful purposes precisely the same. The Jury had still to be made acquainted with the title and specification of the plaintiffs' patent; but it would be found that they only illustrated more clearly the intention of the defendants to infringe it. For though the patent of the defendants did not embrace all that the plaintiffs did—being limited to the boiling of water for steam-engines: yet what it did embrace was borrowed from the plaintiffs. It was natural when people had no particular feeling for their neighbours that they should help themselves to the best slice, and so the defendants had acted; they had picked the plums out of the pudding; for they had taken that part of the plaintiffs' invention which was most likely to be beneficial to the inventors. The plaintiffs' patent, which was obtained in 1818, was, in the first place, for "a machine or machines for removing the inconvenience of smoke or gases generated in stoves, furnaces, or fire-places, by the ignition or combustion of coals or other inflammable substances." That was an universal purpose, for the invention might be applied to every fire-place of every sort where it was worth while to apply it. The plaintiffs' patent was, secondly, for "in certain cases directing the heat and applying such smoke or gases to various useful purposes," that is, either to the boiling of water or any other purpose where heat is required. Such was the *title* of their patent. Now, what said the specification? After repeating the title, it went on thus:—"I do declare, that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained in manner following, that is to say, our said invention consists in making and forming a machine or machines for the heating of boilers, and may be denominated improved air-tight stoves, furnaces, or fire-places." The defendants taking hold of these expressions, had said, "Oh, you call yours an '*air-tight*' apparatus, do you; but we will make something which is *not air-tight*, and for which we shall take out a patent that will give the go-bye to yours." And so because they had left their flue open at its termination, they were pleased to contend that this was such a difference as put the plaintiffs' patent quite out of the question. The Learned Counsel had always understood that the words used in specifications are to be interpreted in the sense in which they are ordinarily employed. Whether there was any thing absolutely *air-tight*, physically speaking, it was hard to tell. It was said that if you let down from a ship a thousand fathoms deep a bottle closed as tight as possible, it will come up filled with sea-water. Water, too, and even air, can be forced through gold; yet any body speaking of gold would say it was both air and water tight. Lord Cochrane and Mr. Galloway did not mean to say that their fire-place was hermetically sealed; it would have been ridiculous to use the word in that sense. All that they meant was, that there was no free communication between the interior of the furnace and the external atmosphere — neither where the fuel was dropped in, nor where the cold air was blown in, nor where the smoke went out—and that was the fact. But, say the defendants, "We have nothing like your valve or means of stoppage at the end of the flue." No, they had not; but they had copied that other material part of the plaintiffs' invention—the making the tubes go thinner and thinner, thus producing a certain extent of compression.* The plaintiffs, after so designating their furnaces, proceed in their specification thus.—"into which coals or other inflammable substances shall be used to generate and convey heat by the ignition and combustion of coal or other fit substances, and which air-tight stoves, furnaces, or fire-places, must be composed and formed of any suitable materials, and with means which will permit the entrance and prevent the escape of any atmospheric air or gas into or from such stove, furnace, or fire-place, *except at the situation or situations formed for the introduction and exit of such air or gas*." The plaintiffs had shown here clearly what they meant by the word "air-tight"—simply this, that the apparatus should not be opened to the air as a common fire-place, but that the air should come in and go out at those places only where it was intended it should come in and go out. The specification then described how that was to be done, and gave a particular exemplification of the application of the apparatus to the heating of a boiler for generating steam. The question, then, to be now determined was, whether the principle which the plaintiffs had thus distinctly embodied in their patent and specification, had not been unfairly taken advantage of by the defendants—whether the defendants had not substantially—directly—imitated the invention of the plaintiffs? The amount of damages was nothing; the whole object of the trial was to ascertain the point of infringement. "There, Gentlemen," said Mr. Pollock, "is the plaintiffs' invention, and below it the defendants' (exhibiting a drawing.) Now, I ask you, whether as far as regards the boiling of water for the service of steam-engines, for culinary purposes, or any purpose connected with the arts—I ask you with a confidence which I must say, as far as I am concerned, is very great—whether this machine of the defendants is not an imitation of that of the plaintiffs? If it is not for all purposes identically the same, what is it? Are we to be told, that because the defendants' flue goes out at the top instead of the bottom, and is round instead of square—or that because they reject the part which relates to the column of water—a part of the invention which has nothing to do with the suppression of smoke[*] or the application of the steam—are we to be told, that for these reasons Lord Cochrane and Mr. Galloway are to be kept out of a most valuable part of their patent? Public health may be benefited by those parts of the invention which relate to the consumption of smoke; but for all purposes of individual profit, the thing to be looked to, is its application to the steam-engine, that great instrument of our manufacturing and commercial wealth. It is this—the most valuable part of the discovery—which the defendants have picked out and taken to themselves. But that, Gentlemen, I am sure they will not be allowed to do. I trust, that by your verdict the plaintiffs will be restored to their rights in their invention—an invention which I submit is as valuable a one as was ever submitted to the test of a public inquiry."

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[*] A question more to the point would have been, "Is this ingenious device which you have just been describing to us, set forth in the *specification* of the plaintiffs?" For "the model" referred to was no more than the drawing exhibited by the learned Gentleman, a true representation of the sort of apparatus originally patented. Had such a question been asked, Mr. Pollock must have been brought to a dead stand in his harangue *There is nothing of the kind in the specification.* The machine of the plaintiffs, as first constructed, had merely a common throttle-valve, and *no* "apparatus for shutting and opening it at pleasure;" the consequence of which was, that as soon as it became clogged with coal dust it ceased to act. The arrangement which Mr. Pollock described was another of those after-thought imitations by which this case is so honourably distinguished. See Mech. Mag. No. 389, p. 302.—ED. M. M.

[*] See engraving in Mech. Mag. No. 389.

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* It has been shown, in a preceding note, that in this instance it was the plaintiffs who copied from the defendants, and not the defendants from the plaintiffs.—ED. M. M.

Mr. John Galloway was then sworn, and about to be examined, when

Sir **James Scarlett**, for the defendants, rose and said, he would in this stage of the proceedings, submit to his lordship one or two objections which he thought would prove fatal to the validity of the plaintiff's patent. In the first place, the terms used in the specification were of so sweeping a nature, that unless the word "air-tight" were adopted in its strictest sense as an essential feature of their invention, their patent would comprehend every sort of fire-place which could be constructed, in which the atmosphere was made to come in at one end and go out at the other, by valves or pumps, or any suitable machinery of any kind? But could such a thing be allowed? Even the most common fire-place would come under the plaintiff's patent, since undoubtedly it was so constructed as "to permit the entrance and escape of the atmospheric air" only "at those situations formed for the introduction and exit of such air." And still, more certainly, would close stoves fall within the plaintiff's claim, which had only a few holes to admit the atmospheric air, doors that were only opened occasionally to admit fuel, and extremely small flues to carry off the smoke and heated air. The invention of the plaintiffs could only be separated from these and others of a like nature, by holding *air-tightness* to be an essential feature of it. Now this the plaintiffs had not done; they merely said that the stoves which they had invented "*may* be denominated improved air-tight stoves," leaving it quite uncertain whether this air-tightness was to be considered an essential part of the invention or not. The law did not allow of such vague specifications as this. Every inventor is bound to state distinctly and clearly what it is that distinguishes his invention from all others, and the plaintiffs in the present instance had done nothing of the kind. In the second place, the plaintiffs had described their invention as being for certain *objects*; though every one knew that no patent can be taken out for an *object* merely. They say: "Our invention is of a threefold character." And "the first part of it is for removing the inconvenience of smoke or gases." Now, that was an *object* common to every chimney-place and every flue. "The second part is, in certain cases, for directing the heat so generated;" that also was an *object* merely—the object of every invention which has for its immediate purpose the application of heat. "The third part" is said to consist in "applying such smoke or gas to various useful purposes;" and here again a mere object was claimed, and such an object that, could it be legally the subject of a patent, every machine, the intention of which was to apply gas or smoke to any useful purpose, would fall within the plaintiff's exclusive right. The plaintiffs then specify particularly how furnaces or stoves should be constructed according to what they call their plan;

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[*] If not, how did the plaintiffs propose to purify their smoke? Mr. Pollock must have mistaken his instructions on this point. The "column of water" was *the only* means pointed out in the specification for purifying the smoke, or as it is there very learnedly stated, "cleansing it of its mucilaginous properties." The *mucilaginous* properties of smoke! The plaintiffs might as well have talked of the mucilaginous properties of iron-stone or granite.—Ed. M. M.

but these particulars it was unnecessary to go into, for at the conclusion, they say, "The abstract parts, or the combinations of machinery by which we construct our air-tight stoves, furnaces, or fire-places, *we do not claim.*" They neither claim the abstract parts, nor any of the combinations, and yet their patent is for "a machine or machines!" How a machine could be denominated original, and be the subject of a patent which the parties did not claim, either in its abstract parts, or as a whole, the learned counsel was quite at a loss to comprehend.

Lord **Tenterden**.—"Except so far."

Sir **James Scarlett**.—Yes: "except so far as they are necessary as means to effect the object of our invention." *To effect the object* merely, be it observed, so that any possible combination of any machinery whatever, which might have the same *object* in view as the invention of the plaintiffs would be an infringement of their patent. The plaintiffs disavow the invention of the machine; they claim only *the object* to be effected by it; which object is neither new in itself, nor more than any other object fit matter for a patent. They say farther, that "these objects may also be effected and produced by other abstract parts and combinations of machinery not explained or described;" an admission which illustrated very strongly the objection just urged, inasmuch as it amounts to this, that though you do not use any part of our machinery, or our combination of machinery, yet if you effect *our object* in any other way, you infringe *our patent*. They follow up this by saying: "yet such alterations may be made, embracing the principles of our invention, that may be a different modification of them and yet be substantially, in their effects and principles, our invention, which is for the working or making a manufacture, being a machine or machines for removing the inconvenience of smoke or gases, generated in stoves, furnaces, or fire-places, by the ignition or combustion of coals or other inflammable substances, and in certain cases for directing the heat and applying such smoke or gases to various useful purposes." You had thus, at every turn, *the object* of the patent; the plaintiffs do not claim any particular machinery, but every sort of machinery, by which that *object* can be effected; they admit that it may be effected by "different modifications" but give you distinctly to understand, that if you accomplish the same *object* in any way whatever, you will infringe their patent. Now, if a mere object could be made in this way the subject of a patent—if every person were to be precluded from taking out a patent for effecting the same object, till that first patent was expired, then would there be a complete stop for the time to all improvement, as regards that particular object. But the policy of the law, it was scarely necessary to say, was to encourage and not to impede, the progress of improvement. The learned counsel had now stated those objections which appeared on the face of the record, to the validity of the plaintiffs' patent, and he left them with perfect confidence to the judgment of his lordship.

Mr. **Rotch** (who was with Sir James Scarlett) begged to point out another material defect in the plaintiffs' specification. They set forth, that the objects of their invention must be effected by "suitable machinery," which should be "capable of supplying any required quantity of atmospheric air," and forcing out the smoke or gases generated "against any required resistance or pressure." But nowhere did they specify the quantity of force or the quantity of pressure requisite to accomplish the objects of their invention; they furnished no data whatever from which a person of ordinary skill could infer either how much air should be forced in, or how long it should be kept in, or what pressure would be needed to prevent its escape. A person desirous of making such a machine as is described in the specification would be obliged to have recourse to experiments of his own to ascertain these points; and all this for want of information, which it was the duty of the plaintiffs to have furnished.

Mr. **Pollock** submitted that the objection last offered was altogether premature, since it must depend on the evidence to be afterwards led, whether the plaintiffs had described their apparatus, to the satisfaction of practical men.

Lord **Tenterden**.—I think, with regard to the objection taken by Mr. Rotch, that every person must be left to find out for himself what degree of pressure will be requisite.

Mr. **Pollock** would then confine himself to the objection taken by Sir James Scarlett. It was an objection which applied to the specification only, and it was not every fault in a specification that would vitiate a patent. The patent was for "a machine or machines," *not* for any mere object; and provided the specification contained a sufficient description of the "machine or machines" so patented, and claimed nothing as new which was not new, it was of no consequence what it contained about the objects of the invention.

Lord **Tenterden.**—You have not, Mr. Pollock, answered the observation as to the air-tightness of the stove; that is a material point, in relation to the invention of the defendants which is not air-tight.

Mr. **Pollock.**—I really did not consider that my learned friend intended to press that objection, and I do not rightly understand how he applies it.

Lord **Tenterden.**—Sir James Scarlett says, that unless the word air-tight is to be considered a material part of the description—unless air-tightness is an essential part of the invention, than the general words would comprise every possible fire-place and stove.

Mr. **Pollock.**—The word "air-tight" was not used in its literal sense, but as synonymous with "closed," and it was used not in the title of the patent but in the explanatory introduction to the specification which formed no essential part of the specification. The learned counsel remembered a case in which the plaintiffs recovered a verdict, notwithstanding the use of a word which literally interpreted signified a great deal more than they intended to express by it. It was said, at the beginning of their specification (as in the present case) that certain effects were produced by *imponderable* substances, but it afterwards appeared that they meant by this certain airs. Lord Chief Justice Dallas before whom the case was tried, and who was an able chemist and well-acquainted with such matters, remarked upon this, that *airs* were *not imponderable.* Some things there were that could not be weighed, but airs were not of the number; mind for example, which was at times very imponderable.

Lord **Tenterden.**—And sometimes very ponderable or ponderous.

Mr. **Pollock.**—Lord Chief Justice Dallas had nevertheless decided that the mistaken use of the word *imponderable* did not make the patent void; it being clear that the patentee had followed common usage in applying it to airs or gases which were popularly regarded as without weight, or, at least, without any ascertainable weight. So, in the present instance, the word air-tight was employed, and properly employed, to describe a stove, which, though not literally air-tight—for, undoubtedly, the air must come in and go out—was air-tight when compared with all other stoves.

Mr. **Hill** followed on the same side. The whole of Sir James Scarlett's objections, turned on the language of the plaintiffs' specification; but he (Mr. H.) had his lordship's authority for saying, that this was a practice which had been already carried far enough in construing patents, and ought not to be carried any further.

Lord **Tenterden.**—I certainly am of this opinion in general.*

Mr. F. **Kelly** enforced the arguments of Mr. Pollock and Mr. Hill. He thought nothing could be more marked than the difference between the plaintiffs' stove and every other sort of stove. In all other stoves it was impossible to regulate either the quantity of air which came in or went out; but here you had every thing under controul—you could throw in exactly as much air as was wanted, and you could retain it for any length of time you pleased.

Sr **James Scarlett** replied. The patent was, it is true, for "a machine or machines" and the specification sets forth a machine; but then, at the conclusion, the patentees say they claim neither the construction of machinery they have described, nor any of its abstract parts. What then did they claim? Why, every combination of machinery which could effect the *object* of their invention. And what was that object? It was not necessary to go to the specification to find that out; it was stated in the patent to be the "removing the inconvenience of smoke or gases." The patent was for that purpose or object alone, and nothing else. But to remove the inconvenience of smoke was not even a new object; it had been the object of many inventions and patents before this. The learned counsel would suppose an analogous case—that a man were to take out a patent for a machine for boiling peas—that he were to describe that machine with the utmost exactness in his specification—but that, at the conclusion, he were to say, "Now, be it understood, that neither the abstract parts of the machine, nor the combination of them, are what I claim, but every combination and modification of machinery which shall have substantially the same effect as that herein described, namely the boiling of peas." Would it be contended that such a patent as this could hold good? That you were to be content to go with your peas unboiled, unless you chose to use the machine of this patentee?

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* This may be regarded as rather an important intimation to patentees; for hitherto, Lord Tenterden has been generally considered (how justly, we shall not now enquire) as the judge before whom, of all others, a patent not in perfect accordance with its specification, was in most imminent danger. —Ed. M.M.

Mr. Pollock.—That is quite a different matter.

Sir **James Scarlett.**—It was, however, a simple and an apposite illustration. For the boiling of peas was not more familiar to the cook, than the removing the inconvenience of smoke was to the world of science. The patent of the plaintiffs was so worded that no man could invent a means of consuming smoke without being open to a charge of infringing it. It was of no use to look at the specification, for you were there told that the plaintiffs did not limit their claim to the machinery therein described, but extended it to every sort of machinery that could produce the same effect; you might invent such a machine as was never heard of before, yet if it had the accomplishment of the same *object* as that of the plaintiffs in view, you were not to be at liberty to use it. Certainly it could never be the intention of any patent, to confer such a power as this. Mr. Pollock had disclaimed the use of the word "air-tight" in its strict sense, and, in doing so, had given up the only feature of originality that could be supposed to belong to the plaintiffs' invention.

Mr. Pollock.—I beg to say, that the question was before the Lord Chancellor Lyndhurst, whose knowledge, I need not say, in matters of this sort, is equal to that of any judge, and that no such objection as this was ever taken before him, though the matter was discussed at considerable length.

Sir **James Scarlett.**—Since Lord Lyndhurst's name has been mentioned, I must mention that a motion was made before him for an injunction on behalf of the plaintiffs, which was refused.

Lord **Tenterden.**—With every deference for the learning and skill of that noble lord as applied to subjects of this kind, in regard to which he possesses much greater knowledge than I do, I must decide according to my own judgement, however deficient. It appears to me, that the word "air-tight" used as it is here, in connection with many other words, means only "closed." The apparatus is to be closed in such a manner, as that atmospheric air shall not enter, except at those parts where it is meant to enter, and shall not pass out except at those parts where it is meant to pass out. That appears to me to be the true sense of this specification. For the present, therefore, I must take it that the specification does sufficiently describe the machine. What is stated at the conclusion—whatever words are used, is, perhaps, not very important; some of the language used goes certainly far beyond the apparatus or machine, and would, as Sir James Scarlett says, include every description of furnace or fire-place; but I am of opinion that the words, large as they are, are to be limited in sound construction, and in point of law to every such combination of abstract parts as shall be, in point of fact, similar to the plaintiffs' machine, and, therefore, an invasion or infringement of their patent. I am, therefore of opinion againgst both the objections.

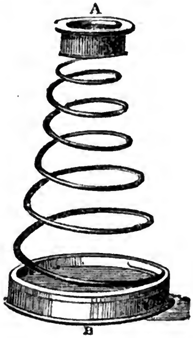
Sir **James Scarlett.**—Perhaps your lordship will be good enough to take a note of that?

Lord **Tenterden.**—Certainly.*

(To be concluded in our next.)

NEW, SIMPLE, CHEAP, AND IMPROVED OPERA-GLASS.

(From the Kaleidoscope.)



The best constructed opera-glasses now in use are subject to a defect which materially detracts from their utility, and which is completely remedied by the simple means which I am about to communicate.

The principal use of the opera-glass is to trace the varying expression of an actor's countenance, upon which much of the interest and effect of his performance depends. Every step he advances or retreats on the stage renders a corresponding alteration in the adjustment of the sliding-tubes necessary. It is neither easy nor always practicable by means of the ordinary opera-glass to make these necessary transitions with the requisite readiness and precision without removing the instrument from the eye. The tubes are apt to move stiffly or in jerks, in consequence of the moisture to which they are necessarily exposed in the atmosphere of a crowded theatre. To remedy this defect, I many years since constructed the simple instrument I am about to describe, which not only obviates the objections just adverted to, but also possesses several other advantages over the best opera-glasses of the ordinary construction.

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* We consider it a matter of regret, that the course which this case has taken, will prevent this opinion of Lord Tenterden's from being brought under revision. It is very much at variance with many preceding decisions, and will, we fear, have a tendency to encourage a laxity in the language of specifications, at once unfair to the public, and hazardous to patentees. Perhaps the practice of strict interpretation has been carried, in some instances, *too far*; but this, at least, must be allowed, that the error has been on the safe side. To admit of such a loose and sweep-all style of specifying as this decision of Lord Tenterdens' goes to sanction, will be to open the door to a flood of abuse.—Ed. M. M.

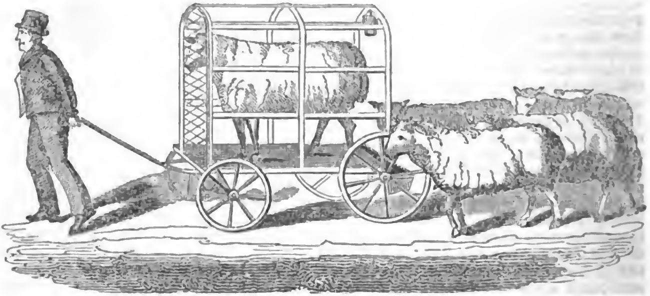
A simple inspection of the annexed engraving will render the principle of this instrument obvious to every reader. No tubes are necessary, their place being supplied by a neat slender, elastic, conical spring, into the upper extremity of which the eye-glass is inserted; and the object-glass is fixed to the other extremity. The two glasses must, of course, be kept parallel to each other when in use; but this is very easily effected, as has been proved by myself and other persons. In using this opera-glass the finger and thumb of one hand rest on the rim of the object-glass B, whilst the thumb and finger of the other hand hold the rim of the eye-glass. In this position the spring-tube may be elongated or collapsed instantaneously to the thousandth part of an inch. The ordinary sliding-tubes, as I have already observed, are entirely superseded in this opera-glass, neither is any external covering necessary, as the hand in grasping the instrument serves the purpose. If, however, a covering be preferred, a piece of light silk may be easily sewed to the spirals of the spring.

It only remains to add that, independent of the superiority already adverted to, this kind of opera-glass may be made very cheap; besides which it may be compressed into a very small space for the pocket, merely by pressing the object and eye-glass together. It is also very elegant in its form.*

EGERTON SMITH.

HUMANE SHEEP-CONDUCTOR.

(From the Voice of Humanity.)



The principle upon which this mode of conducting sheep through the crowded roads of the metropolis is applied, is the instinctive disposition which sheep exhibit *to follow their species*, so that if *one* escapes, it is almost impossible to stop the rest of a flock. By this *little caravan* a tired sheep, instead of being cruelly beaten, might assist in leading his companions. By confining the sheep with a collar, the carriage may be open all round, which is desirable; a sheep-bell attached to the car has been found an improvement; and, from the parched state of the poor creatures' mouths, a small tin trough, to contain water, induces them to approach more readily.

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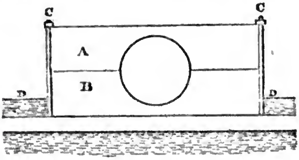
* The specimen instrument in my possession, which is between three and four inches in length, is not one inch when shut up in its case.

PADDLES APPLIED TO WHERRIES.

Sir,—In a recent number of the Mechanics' Magazine, a *Lover of Aquatics* puts a few questions upon this subject. Having myself been a speculator in this line, I take the liberty of offering the following remarks in reply to your correspondent. In the year 1822, I fitted up a four-oared boat with paddle-wheels, the diameter of which was 3 feet 8 inches; each wheel was turned by a separate winch, so that the man who worked the paddles could steer his boat without any other assistance. I at first used the *wheel and pinion*, but I found the friction too great to be overcome sufficiently to give adequate speed to the paddles. I then removed the *wheel and pinion* and worked with a simple *winch*. The *main shaft* or *axle* worked in a *gudgeon* sheathed with copper. In order to be able to ship the paddles at pleasure the *gudgeon* was divided, the lower half being made fast to the *gunwale* of the boat, the upper half screwing on and off, thus:



A upper half of gudgeon.
B lower ditto.
C C screws.
D D gunwale of boat.

And to secure the *axle* still better, a wooden *stanchion* was fixed inside the boat in which the *axle* rested. Allowing that the machinery was of a very rude description, and that it might, by a more scientific arrangement, have been rendered much more effectual, I am inclined to think with every advantage, this mode of propelling small boats would always be attended with greater labour than with oars, to say nothing of the weight of the machinery, the power of wind upon the paddles, &c., and the inconvenience arising to the passengers from the splashing of the water, which paddle-boxes cannot sufficiently prevent. In No. 11 of the Mechanics' Magazine is a sketch of a boat which plied on the Avon on this principle, and in No. 59, another article will be found on this subject. I do not know whether the plan therein mentioned was ever tried, but I should be very much pleased to learn of the poor fellow's success. All *I* can pretend to say, is, that mine was a complete failure, which has, perhaps, made me more sceptical than I ought, as to the advantages likely to be derived by substituting paddles worked by hand for oars.

Yours, &c. A WATERMAN.

August 15, 1831.

MR. BERNHARD'S METHOD OF RAISING FLUIDS.

(See Mech. Mag. vol. xv., *p.* 138.)

A friend of Mr. Bernhard's, resident in this country, informs us that it appears, from "a letter lately received from him, that he is prosecuting the trials at Munich with his quicksilver machine, the stream of which, he says, has, on each occasion, continued to circulate without an instant's interruption during the whole space of each exhibition being generally from three to four hours long. Mr. Bernhard further mentions, that he is now engaged in erecting at Munich a machine on the same principle, for raising water, and that he finds the expense of the fuel used is comparatively trifling, so much so, that in a manufactory where, for other purposes, there was a boiler to be kept heated—a dyer's, for example—the heat from the upper portion of the chimney of such boiler would be sufficient to heat his apparatus for raising water 50 feet above the Torricellian column !"

CAUSE OF THE REPORT IN EXPLOSIONS.

Sir,—It is stated in most works on natural and experimental philosophy, that the report of fire-arms is occasioned by the force with which the air, that rushes in to fill the vacuum left at the exit of the charge, strikes the bottom of the piece; and this position is supported by reference to the experiment in pneumatics, of bursting a bladder tied over an open-topped receiver, when the superincumbent column of air rushes into the vacuum, and striking the pump-plate, causes a loud report.

There are, however, numerous cases in which no vacuum is formed, and yet a like report is produced; such, for instance, as the discharge of a boy's pop-gun—the bursting of a blown-bladder—or of a paper bag filled with air; a loud report also attends the explosion of the mixed gases in a close vessel, where, although a vacuum may be formed, yet, no air can rush in to occasion the sound that is produced.

Again, if the report of fire-arms is occasioned by the rush of air into a vacuum, the sound produced with the same gun, should, in all cases, be equal; seeing, that atmospheric pressure, and the velocity with which air enters a vacuum, are always the same, or nearly so; and yet, we know that the sound is greatly modified by various circumstances. Thus, we find that sawdust mixed with gunpowder, greatly increases the sound, and so, with several other substances which produce a similar effect. The sound produced is also greater, the harder the charge is rammed down; if the interior of a cannon be rubbed with tallow, the report is very much increased, and the report is still louder, if the *wad* is soaked with tallow.

Half an ounce of gun-powder laid in a heap upon a board and fired, produces but little sound; if, however, it is tightly bound up in strong paper, a very loud report is produced; the vacuum must be of the same extent in either case, and there is nothing more for the air to strike against in the one instance, than in the other.

I shall feel obliged to any of your correspondents, who will reconcile these several experiments, with the generally received theory of the production of sound; or otherwise furnish some more satisfactory mode of accounting for the same.

Yours, &c. W. Baddeley.

August 22, 1831.

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THE TETBURY COINS.

Sir,—Since addressing you on the subject of the Tetbury coins, I have seen a few, out of the immense hoard. These consisted chiefly of coins of the first and second Edward, minted at the following places:—London, Canterbury, York, Durham, Newcastle, Bury St. Edmund's, Dublin, and Waterford. There were also coins of Alexander III. of Scotland, (Anno 1249), and of John Baliol, (Anno 1292), the latter minted at St. Andrew's, also counterfeit sterlings,

Inscribed GALCHS COMES PORC
Reverse, MONETA NOVA IVE.

Gaulcher, Count of Porcien, Constable of France, had the country of Porcien given him by Philip of France, Anno 1308.

In referring to Holinshed, under the reign of Edward the Second, A. D. 1322, I find the following passages:—

"At his[*] coming to a little village called Caldwell he sent afore him certaine bands to Burton-upon-Trent, where he ment to have lodged; but the Earles of Lancaster and Hereford, the Lords Roger Damorie, Hugh Audelie the Younger, John de Moubraie, Bartholomew de Badelismere, Roger de Clifford, John Gifford de Bremeffeld, Henry Tieis, and many other, being gotten thither before, kept the bridge, and assailing the King's people, which he had thus sent before, some of them they slew and some they wounded, so defending the bridge that none could passe; and by reason that the waters and speciallie the river Trent, through abundance of rain that was latelie fallen, were raised there was no meane to passe by the fords; whereupon the King was constrained to staie the space of three daies, in which mean time, the Earles, and their accomplices, fortified the bridge at Burton with barriers and such like defenses, after the manner of warre, but the King at length upon deliberate advise taken, how to passe the river, ordeined that the Earle of Surrie, with certaine armed men, should go over by a bridge that was three miles distant from Burton, that he might come upon the backes of his enemies, as they were fighting with those that should assaile them afront."

"But after that the Earles of Lancaster and Hereford, with their complices, heard that the King had passed with his armie, they came forth with their people into the fields and put them in order of battell: but perceiving the great puissance which the King had there readie to encounter them, without more adoo they fled, setting fire on the towne, and leaving all their vittels and other things behind them."

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[*] The king.

"On the same night, being Wednesdaie, the King came to Tutburie and lodged in the castle."—Vol. III. p. 330.

I have been told that with the coins has been found the remains of a military chest, in which they were contained. There appears, therefore, every probability that this treasure lately found was for safety buried in the earth, by some of the Rebel leaders, upon the advance of the King's troops; and that as after their defeat, many of them were taken and beheaded, the knowledge of its being thus deposited died with them. The present course of the river is said to be of comparatively modern date.

Yours, &c. Δ.

Wellesbourne, Aug. 29, 1831.

P. S.—I hope to receive from some one of your correspondents a description of the larger and side-faced coins, I referred to in my last.

SILVESTER'S IMPROVED STEAM-BOAT.

(From a Correspondent.)

A model of a steam-boat has been constructed by Mr. Silvester, which is propelled without paddle-wheels, and without causing any disturbance upon the face of the water. The moving power is given by paddles of a very curious, and at the same time, scientific construction, which work entirely beneath the surface. Steam-boats of this description may be safely introduced upon canals and small rivers, from which they have hitherto been excluded, from a fear lest the banks should be injured, or other craft endangered; and from the circumstance that the paddles can be folded close to the sides, narrow locks may be passed with ease and safety.

With respect to the navigation of larger rivers, the general adoption of Mr. Silvester's plan would prevent those destructive accidents to life and property, which are, at present, so alarmingly frequent, as no swell in the water would be occasioned; the smallest vessels might even come alongside one of the improved steam-boats, when in full action, without the slightest danger, and the greatest rate of speed might be maintained in the most crowded parts of a river. In traversing the open ocean, a vessel of this description would possess many advantages over those of ordinary construction, the patent paddles might continue in use when the weather was too boisterous to permit the employment of paddle-wheels, whilst the vessel would for several reasons be in every respect a better sea-boat; it would, in fact, exhibit no outward indications of being a steamer; the huge ugly paddle-boxes would of course be entirely removed.

The model, which has a miniature steam-engine fitted to it, has had several trials, and notwithstanding the disproportionate friction to which all machinery upon a small scale is subject, and the difficulty of keeping up the steam in a little vessel immersed in cold water, performed its part with so much success as to remove all doubts from the minds of the spectators—amongst whom might be named an eminent practical engineer—of the perfect practicability of the plan.

Mr. Silvester is now endeavouring to procure the necessary funds to establish a steam-boat to run from Hungerford Market to Gravesend.

It should be mentioned, that in consequence of the improved steam-boat having no back-water to contend with, and some other favourable circumstances, only two-thirds of the steam power usually employed will be requisite; of course, there will be a proportionate saving of engine room.

FRUIT AND VINEGAR STAINS.

We learn, from a fair correspondent, to whom we lately recommended the employment of a solution of chloride of lime, to remove some fruit stains from ivory knife-handles, that she had applied chloride of soda (which the apothecary very truly told her was "much the same thing") with the most perfect success—the stains disappearing in less than two minutes. We had also, on the faith of the general hostility of the chloride of lime to vegetable colours, advised the lady to apply it to some linen which had been stained with vinegar; but, we understand, that in this case, it has had no effect whatever. "I also tried," says the lady, "common bleaching on the grass, and boiling, without producing the desired effect. I mentioned this to the apothecary, and he said that some mineral must have been used to colour the vinegar, but that he could not say what would remove the stain it had left." We are of the opinion of Mr. Apothecary; the vinegar must have been adulterated—probably with sulphuric acid (oil of vitriol); and if that is the case, we are equally at a loss to know what will remove its stains. If any of our chemical readers are in possession of a remedy, we shall be glad to make it public, for the benefit of our correspondent and of housewives in general.

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ON PLANTING LENGTHWISE AND DIAGONALLY.

Sir,—As my object in writing to you on this subject was only to ascertain the truth, I beg to thank Mr. Snooke for his correction of the mistake, into which I had fallen; and I agree with your correspondent, that the total of the diagonals and of the lines lengthwise in the square (the figure which I gave) will be the same. But I do not perceive with Mr. S. that in altering the square to any other rectangle, we shall alter the corrected result which he has given in the first part of his letter; viz. that the total of lines in both cases are equal. For, assuming the two rectangles which he mentions, the total amount by the diagonal method will be as set down = 1200 inches. By dividing, however, the same figure lengthwise, we shall not be able to obtain 16 lines included with the figure, for, commencing with the first line any where within 4 inches from the one boundary line, the 16th will be the same distance beyond the other; and it will only be by considering the one boundary line as the first, and the other as the sixteenth, that we shall be enabled to draw 16 parallel lines in 60 inches; and since all the diagonal lines are *included within* the figure, the case will not be similar. Thus, supposing in the rectangle, containing the lateral lines given by Mr. S., the first line were to commence the $\frac{1}{4}$th of an inch from C D, the sixteenth will be $\frac{1}{4}$th of an inch beyond the 60 inches; and so, of any other distance from C D, so that it would be impossible to *include* 16 lines *within the boundaries* of the figure; therefore, 15 lines multiplied by 80, will give 1200, the same amount as the diagonal lines. The correction which Mr. S. has given in the first part of his letter, will, therefore, not support the making a difference in favor of the lateral division; but both will, I admit, contain the same.

Thanking you, for the information I have obtained and the space I have occupied in your periodical,

I remain, Sir, yours, &c.

S. B.

September 1, 1831.

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DISCLOSURE OF INVENTIONS.

Sir,—I beg leave to submit the following case to you. Suppose A has invented a mode of manufacturing an article, and shows it to his friend B, wishing his opinion of the invention *previous* to taking out a patent: can B invalidate A's right to the patent *after* A may have patented it? To my surprise, I am told that he can. Will you be pleased to favour me with your opinion on the point, through the medium of the Mechanics' Magazine.

I am, Sir, yours, &c.

G. M.

Aug. 29, 1831.

[Should the friend to whom our correspondent has confided his secret prove false, then we are sorry to say there will be no hope for him. When the State bargains with a person, that if he will make a full discosure of some new and useful thing which he claims to have invented or discovered, he shall have an exclusive monopoly of the use and manufacture of it for a term of years (for that is the true character of a patent), it is with the perfect understanding, that he has not already so disclosed it, or so made it public, that the country can have the benefit of it, without submitting to such a preliminary monopoly. But how can an inventor be said to be in this situation, who has entrusted his secret to a person not worthy of being trusted, and through whose treachery it may be in the knowledge of thousands by the time the patent is granted? It may be some consolation, however, to our correspondent to know, that his false friend B cannot himself be the legal instrument of invalidating the patent; third parties deriving a knowledge through B of the invention, will be at liberty to impeach it; but it would not be competent for B himself to bring a *scire facias*, founded on the disclosure which A had made to him.—Ed. M. M.]

NOTES WORTH NOTICE.

"Every one daily either hears, or reads, or sees something which others would gladly be acquainted with."

A start in Civilization.—A Mr. Silverton, of Newington-green, in a letter addressed to the "Voice of Humanity" (an odd name, by the way, for a periodical work—*Journal of Humanity* would have been better) says, "In perusing papers which have very recently arrived from New South Wales, I have been struck by perceiving, that amongst the latest acts of the Legislative Council of the Colony, are two to the following effect;—"An act for regulating the slaughtering of cattle, and for the improper driving of the same through the streets of Sydney," and "An act for abating the nuisance occasioned by the great number of dogs which are loose in the streets of the towns of Sydney, Paramatta, Liverpool, and Windsor, in the colony of New South Wales." In that comparatively infant colony, they find it necescary to check the evil in its very bud; we, far more civilized, have allowed it out of a pretended regard to vested interests, but with a total disregard to the interests of morality, decency, health and safety, to remain; and not only to remain, but to grow and increase in magnitude and mischief, from year to year, and from century to century!"—Well said, Mr. Silverton.

Value of a good name. — English watches are in high repute, and fetch the highest prices among the Turks. This is the result of some centuries' experience of their soundness and other good qualities. Perhaps, even at the present day, the watches which have the most substantial works, are those intended for the Turkey market, although, it is to be feared, that unprincipled speculators have, by exporting inferior goods on the credit of the English name, greatly injured the trade, to the serious disadvantage of the more respectable watch-makers. The Turks are any thing but capricious customers—where they find a good article, there they will go again for hundreds of years. Of course, it requires time to get into their good graces, and as they know nothing of the inside, they are obliged to judge generally by the outside. Thus, the watch manufacturers of the present day, find it more convenient to make them up in the old-fashioned style; and, instead of their own names, to affix that of some brother of the craft, who flourished in the days of our great great grand-fathers, and whose works, although forgotten at home, are still remembered for their goodness on the banks of the Bosphorus. It is even necessary, although the date should be modern, that the maker's name and residence should be engraved in the style of the seventeenth century. Many a timekeeper is now on its voyage to Turkey, which purports to have been made in 1831, by some citizen, "att his house, facynge y^e Royall Exchange:" although the said citizen has long slept in the dust of a London church-yard.

Literature and Art in America.—"The Library of Entertaining Knowledge" is regularly reprinted in the United States, by Lilly and Wait, of Boston. The wood-cuts are copied in a manner highly creditable to American art, although those we have seen certainly do not come up to the excellence of the originals. The price of a part published here at 2*s*., is, in America, 30 cents, (about 1*s*. 4*d*.), which, considering that they have nothing to pay for copyright, and have other advantages, is *not* astonishingly cheap.

Progress of Science.—An iron suspension bridge has been lately opened at Dacca, in India, which is the first of the kind ever erected in that country, out of Calcutta. In honour of its projector, Mr. Walters, the late judge of the province, it has been determined to call it "Walter's Bridge."

Honors well bestowed.—The King has conferred the honor of knighthood on Mr.—now Sir John—Rennie, the engineer of New London Bridge, as a testimony of the royal approbation of the execution of that magnificient edifice. His late majesty was supposed to manifest his patronage of literature, by giving the first baronetcy in his reign to Sir Walter Scott; by a parity of reasoning, William the Fourth may be expected to give his countenance to the science and the fine arts, inasmuch as the two first persons whom he knighted were Sir James South, President of the Astronomical Society, and Sir Martin Archer Shee, President of the Royal Academy.

Steam-Boats and Life Preservers.—A correspondent of *The Times*, suggests that in any act that may be passed for the better regulation of steam-boats or other vessels employed in the conveyance of passengers from one port to another, it should be made compulsory on the owners of each vessel to provide it with as many life preservers as it is likely to have passengers. This seems a very judicious suggestion. The sort of preserver which the writer recommends, is one made of bamboo canes, because they are tubular, and therefore buoyant, and from the polished consistency of their outer surface, capable of longer preservation than other wood. The canes, he observes, might be divided at their joints and small holes drilled through the pieces, so as to admit of their being attached by strings. "In this manner a breast-plate might be formed, secured above by the two arm-holes and tied below round the waist. This support would keep the head above water and preserve life in warm weather at least for several hours, should assistance be so long delayed." Had such a provision been made in the case of the *Rothsay Castle*, there can be little doubt that the lives of the greater part of the persons who were lost on that melancholy occasion might have been saved.

Welsh-French.—In a treatise on the manufacture of iron in South Wales, recently published by the Useful Knowledge Society, it is said, "the holes through which the blast is admitted to the furnace are called *twyeres* (pronounced tweers)" and throughout the essay these *twyeres* cut a most conspicuous figure. The writer is evidently not aware, that the word he has so Welchified is simply the French word *tuyere*, a pipe mouth (pronounced with tolerable accuracy *tweer.*) The works of this Society are said to be published under the "superintendance" of a Committee overflowing with Fellows of Learned Societies; but were there any real superintendence in the case, such blunders could scarcely happen.

Marshal Soult turned Iron-Master.—We learn from the same treatise to which we have alluded in the preceding notice—and which, though of small literary merit, is by no means deficient in valuable information—that "the Welsh and Staffordshire iron-masters are at this moment actually employed, to their own destruction, in the execution of castings, &c., for a very large establishment, that is forming under the auspices of a public Company in France; one of the chief Directors and Shareholders in this Company is Marshal Soult, hitherto better known in a military than in a commercial capacity. The works are erecting at Alais, in the province of Languedoc, not far from Montpelier. The iron-stone and coal ore are said to be of excellent quality, and most abundant—so much so, that it is confidently anticipated that pig-iron will be made there at half the price that it can now be manufactured at in Great Britain under the most favourable circumstances. The great drawback is the situation of the works, which will be 35 miles from the Rhone, the nearest navigable river, and 40 from the sea. Until a facility is afforded by the establishment of a rail-road or canal, this circumstance will occasion a charge in carriage that will more than double the cost of the iron." F. H.

Ventilation. — The following simple method of ventilating large halls, theatres, &c., has been found by M. Van Marûm to answer most effectually:—Let a common Argand lamp be suspended from the roof, and kept burning under a funnel, the tube of which is carried out into the open air, and furnished with a ventilator. In one experiment made with this apparatus, M. Van Marûm first filled his laboratory with the smoke of deal shavings, and then lighted the lamp; in a few minutes after, the whole smoke had disappeared, and the air was completely purified.

Furnace Hearths.—There is a legend, that on the establishment, many years ago, of a work in Monmouthshire by a Staffordshire person, it was thought necessary to take the stones for the furnace hearths from Staffordshire, and that a stone of some tons weight was actually removed to within a few miles of its destination, when it was discovered that the grit-stones to be found in abundance on the spot would answer the purpose as well! Whether this tradition be true or not, it is a fact that a large stone is now to be seen on the London and Milford road which is pointed out as the identical one alluded to in the above tale.—*Treatise on the Manufacture of Iron.*

Plate Powder.—A Jeweller informs us, he has lately discovered that a composition made of the following ingredients makes an excellent plate powder:—Salt of lemons (strongly diluted with water); a small portion of soda; and pounded chalk. They should be well mixed up, and exposed to the heat of the sun, when the liquid will evaporate and leave a fine powder ready for use the following day. We should think it would be worth while to manufacture such a powder for sale; if sold in boxes for one or two shillings, there could not fail to be a great demand for it.

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INTERIM NOTICES.

Communications received from N. S. N.—Mr. White—G. S.—H. T. H.—Father Thames—Mr. Simpson—Y. I..

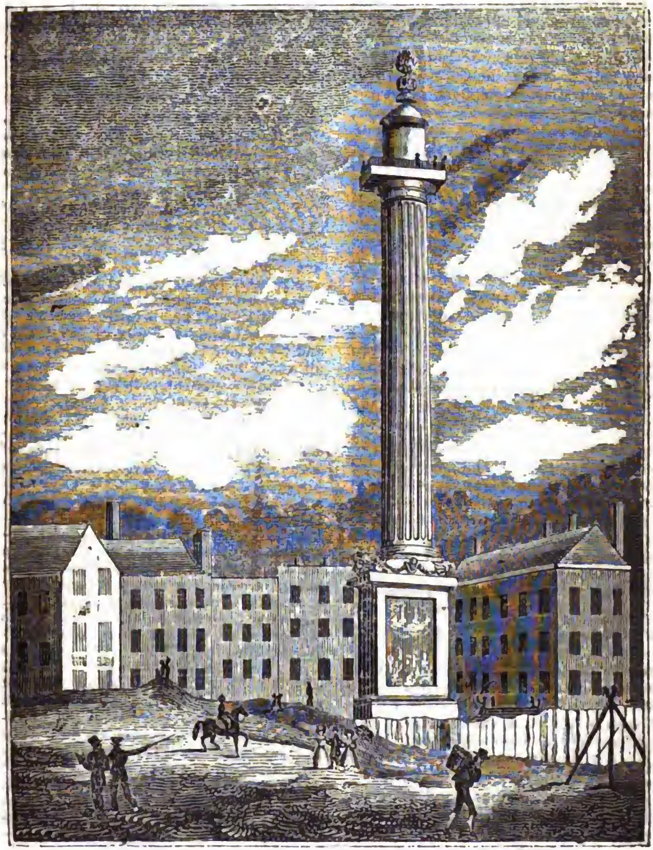
"*Professional Survey of the Old and New London Bridges.*"—The author of this pamphlet has requested of us to point out an important error of the press at p. 45, which has been also copied into the Mechanics' Magazine, p. 396, col. 1, l. 7 from the bottom. For "fifteen *feet*" read "fifteen *inches*."

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-Office-court, Fleet Street.
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 422.] SATURDAY, SEPTEMBER 10, 1831. [Price 3d.

NEW LONDON BRIDGE APPROACHES.



NEW LONDON BRIDGE APPROACHES.

We return to the "Professional Survey" for the purpose of making some extracts from it respecting the approaches to the New Bridge, and introducing a few additional remarks.

The author thinks there is little in the "*principal* approaches" to complain of as regards their "direction, width, and levels,"—"the streets being generally 70 feet wide, which is above double the width of the old streets; and the ascent of the two principal approaches not more than 1 in 30, which is also less by nearly one-half than the present rise of Old Fish Street Hill." It is evident from the reasons which the author here gives for commending generally the approaches, that he did not mean, his approbation should extend to the particular case of the Tooley Street approach, which is almost as steep as Fish Street Hill itself, and liable to all the objections so well stated by our correspondent, Mr. Tidmarsh, (No. 419). We are rather surprised however, he should have passed over so remarkable an exception without any deprecatory remark. Indeed, considering that this is the direct line of approach from so many populous and busy places as lay on the right-hand side of the River below bridge—Rotherhithe, Bermondsey, Deptford, Greenwich, Woolwich, &c.—it seems to us that it had scarcely a less claim on his attention than those "two principal approaches," which appear to have engrossed all his thoughts. We hope that some alteration will yet be made—for there is yet time—in this important avenue to the bridge; for as now laid down, nothing can be conceived more awkward and inconvenient.

The case of the residents of Upper and Lower Thames Streets is perhaps the very hardest connected with the erection of the New Bridge. When the old structure is taken down, they will no longer have that direct access to a bridge across the river which they have enjoyed with so much advantage for ages; foot-passengers from either of these places will have to climb a steep flight of stairs next to the Thames Street Arch—while horsemen, carriages, and waggons will have to make their way up Fish Street Hill, or some other of the equally steep and still narower lanes that lead to Cannon Street, and thence into the grand entrance to the bridge. The author of the "Survey" treats this case in the only light in which it can be fairly viewed—as that of a great but partial sacrifice for the sake of the public good:—

> "We do not know how it could have been avoided, and the interests of the many consulted. Had the bridge been erected on the old site, and the old lines of approach been preserved, it seems quite certain that public convenience would have demanded, that the roadway should be raised to a level that would have left Thames Street and its fruitmen and fishmongers far below."—P. 37.

We are glad to observe, from some recent proceedings in the Common Hall, that it has been determined to give a liberal indemnity to all the sufferers from this necessary change; this is no more than just.

The author's remarks on the style of the new buildings about to be erected at both ends of the bridge, are brief but to the point:—

> "What the architectural character of the approaches to this noble structure may ultimately be, is still a matter of conjecture, mingled (spite of the "skill and talent" of the worthy citizens) with no small apprehension. Large spaces have been cleared at both ends, but how will they be occupied? Covered over again with mean or insignificant buildings? Or with edifices of suitable grandeur and elegance? The assistance of Mr. Smirke has been called in, and from his undoubted purity of taste (we wish we could add fertility of invention) much is to be hoped.
>
> "The main road into the City will, according to present appearances, take a winding direction, but not till it reaches a point, at which the bend will have rather a graceful than an injurious effect. And, as forward to that point, the old houses on both sides, and to a great extent backwards, have been cleared away, there is now a rectilineal space open, of length and breadth enough, to admit of great magnificence of effect being studied, in the style and arrangements of the buildings which may be erected upon it. The Monument, as matters at present stand, is fully exposed to view (see Plate XIII,* which is a view of it as it appeared in June, 1831); and it is to be hoped that in any plan of building which may be adopt-

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* The same as on the preceding page.

ed, care will be taken to keep it so. The erection of another Monument opposite to it, formed an excellent feature of one of Mr. Rennie's plans, and we hope yet to see it realized."

We have nothing to add on this head, except it be an earnest repetition of the hope expressed at the close of the preceding extract. It would give an air of much grandeur to the entrance into the City from the bridge, were it to pass between two such noble columns as the monument.

C. V.

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ACTION FOR INFRINGEMENT OF PATENT.

LORD COCHRANE AND MR. ALEXANDER GALLOWAY V. MESSRS. BRAITHWAITE AND ERICSSON.

Tried before Lord TENTERDEN *and a Special Jury, July* 6, 1831.

(Concluded from page 425.)

The Examination of Mr. John Galloway was then resumed by Mr. Hill.

Do you produce copies of the drawings attached to the defendants' specification?—Yes.

Did you examine them with the originals?—I did, Sir. (They were then handed in.)

Cross-examined by Sir James Scarlett.

Are you the son of one of the plaintiffs.—I am.

Have you ever sold any such machine as is described in the patent?—We have never sold any.

I think, if I remember right, your father had the construction of a steam-boat for Lord Cochrane?—Lord Cochrane was the proprietor of a steam-boat, in which my father used the machine.

Do you know of any other instance in which your father used the machine, beside in that steam-boat case?—Yes, in some other cases for ourselves.

Was that before the defendants took out their patent? What I wish to know is this—whether you ever used the machine in question, in any other case save that of the steam-boat, before the defendants' patent was taken out?—No, we have not.

What became of that steam-boat?—She went abroad.

When was this model made (pointing to the model which Mr. Pollock had referred to in his opening speech)?—About a fortnight or ten days ago.

When was the machine made, of which this is a model?—That model is nearly a copy from the drawing enrolled.

Have you a machine on your premises now, that has been constructed lately?—We have.

When was it constructed?—We have two machines, and I think they have been constructed about 18 months.

Have they not been both constructed since the defendants took out their patent?—I believe they have.

Now, will you cast your eye upon that (showing a drawing)—it is a drawing on a large scale of your machine*?—Yes, it is a copy of one of the figures enrolled.

Now, is not this (pointing to the part D) intended to represent the column of water by which the valve C is to be kept shut?—Yes, that is one of the means suggested.

Well, take that model in your hand, and show us where this column of water is?—*It is not in this: the column of water is not here.*

Is it in any of the machines you have constructed?—Yes.

When did you apply it?—*It has been in existence and constant use for* 18 *months;* beyond that period, I cannot speak positively.

Have you ever seen the machine used with this column of water?—*Many times.*

Have you ever sold a machine of this sort?—We have not.

When you say you have used it, for what purpose have you used it?—For generating steam.

Lord TENTERDEN.—Have you a steam-engine?—Yes; *but we do not work our steam-engine with this boiler.*

Sir JAMES SCARLETT.—*I want to know whether, in point of fact,* you have ever applied it to any useful purpose? We have applied it for generating steam *for many years together,*† which steam was perfectly competent for working a steam-engine or any thing else.

What did you do with the steam?—We let it go into the atmosphere, to show the quantity of water that can be evaporated in a given time.

Was that for the satisfaction of your witnesses?—Yes, some of our witnesses have seen this; but we did it for other purposes.

Did you not do it for the purpose of experiment?—We did it to ascertain the quantity of water which could be evaporated in a given time.

You never did apply it, however, to any practical purpose?—*We never did apply it to a steam-engine;* but it is perfectly *competent to be so applied.*

When did you apply this machine *without a column of water* to your steam-engine?—The machine, we are using for our steam engine, *has not a column of water;* it has a small valve—a small pipe—it is constructed according to another of the modes given in the specification.

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* See Mech. Mag., No. 361.

† The witness said before, that the only machines they had constructed were made after the defendants' took out their patent. For "many years together," therefore, we must read, "many months together."

Which is the other mode pointed out besides the column of water; point me out that other mode?—In the specification, after describing the first mode, it is said, "C is the plate or valve by which the smoke, gas, and heated air, are compressed according to the pressure placed on such plate or valve, either by any weight, or fluid, or by any other known means of producing any required resistance."

But you see there is nothing specific here; show me "the other mode" you were speaking of?—It is said, that the pressure is to be *either* by a weight, *or* fluid, *or* any other known means of producing the required resistance. And, afterwards, it is said, "The pressure on the valve C is regulated by its area, and the height of the external column of water bearing on the valve."

Well, does that explain what you mean, when you speak of *another* specific mode, beside that of the column of water?—Yes; it shows that you may produce the required resistance by any other weight, as well as a fluid, or by a diminished area in the pipe.

Does the specification say area *in the pipe*?—It says diminished area.

Where does it say that?—"The pressure in the valve C, is regulated by its area."[*]

Now, have you a machine applied to any purpose except for experiment, on your premises?—Of what description do you mean—with a column of water?

With or without a column of water?—We have.

Is it in that form (pointing to the drawing)?—It has all the essential parts.

Since when have you applied it?—About 18 months.

Now, put your finger on the valve C, and inform us whether the machine you have constructed and now use, has that valve?—Yes; we have it in the one we are now working.

And has it any weight upon it?—*No; it is only of small area; a small pipe.*

Which is *open to the atmosphere?—Certainly.*

Then the valve *is constantly kept open?—The valve is open.*

Lord TENTERDEN.—The valve is *not confined by water or pressure of any kind?—No.*

Sir JAMES SCARLETT.—Then in the machine you are now using, you pump in air at one end, and that other extremity, therefore, on which you put your finger, is the chimney by which the smoke is conveyed away, *and that is now constantly open?—Yes.*

Neither pressed by the column of water nor by any other weight?—No; but restrained by being small.

Which (smallness) you never had recourse to, till after the defendants' invention?—I have no recollection of it.

Re-examined by Mr. Pollock.

You have been examined a good deal as to the column of water; is that a necessary part of the apparatus?—There are some other modes of compressing the air in the fire.

What is the effect of the valve, and the result of it?—

Lord TENTERDEN.—There is no valve at all in what they are now using.[*]

Mr. POLLOCK.—Your lordship will find there is no occasion for it, when you have ascertained how much aperture you want.

Is it not so (to witness)?—Yes; we can do without the valve; experience has given us the proper quantity.

Lord TENTERDEN.—A proper quantity of what?—Of compression.

Either by diminishing the pipe, or by other means?—Just so, my lord.

Mr. POLLOCK.—If you want to vary the compression, is the valve then serviceable or otherwise?—When we want to vary the compression, the valve is serviceable; because we can vary that to any degree of pressure.

When you have ascertained to what extent the valve may be opened or shut, you reduce the aperture so as to do without a valve?—Certainly.

Lord TENTERDEN—The defendant's machine has no valve at all?—No valve.

So that the air goes out at the orifice?—Yes.

Mr. JOHN FAREY, Civil Engineer, was next examined.—Had seen the specification and drawings of the plaintiffs' invention, and had also seen three boilers at Mr. Galloway's manufactory, constructed on the principle of their patent. Saw two of these more than a year ago; one was at work, supplying steam for the steam-engine, which was doing the work of the manufactory: the other, which was a high-pressure boiler, was not at work. Saw these two boilers again yesterday, and a third which Mr. Galloway had constructed. The machine which he saw at work had not any column of water; the high-pressure one, *which was not at work*, had a column of water to it. The same effect as is stated in the specification to be produced by a column of water was produced by the smallness of the aperture through which the gas escaped, and by the contraction of the flue; *there was no valve.* There was nothing new in contracting the flue for the purpose of compressing the air; it was a device of the same sort as the application of a nozzle to a pair of common bellows. The use of the valve was found objectionable on account of the smoke making it sooty, and rendering its action imperfect. Had particularly observed the mode of feeding the fire; it was by means of a chamber with double slides or doors. The high-pressure boiler *which was not at work* had a turning-valve, similar to what is called a throttle-valve. By keeping the inner-door or slide shut, it prevented the escape of the air; while the outer or external one was opened to let in the fuel. This was an entirely new mode of feeding a fire; it resembled an anti-chamber; thought an anti-chamber would be a good name for it. Till witness saw the plaintiffs' specification, he had never seen any such machine as is there described; thought it a new and very useful contrivance for many purposes. The machine he saw working at Mr. Galloway's manufactory was doing its work very well; it was supplying steam for a steam-engine of 6-horse power. Had likewise seen the specification and drawings of Messrs. Braithwaite and Ericsson's boiler; and is of opinion, that between their No. 3 and the plaintiffs' machine there was no difference, such as could affect the mode of operation. The air is forced into the furnace, and retained there under a state of compression, but it is not retained under that compression by a valve or column of water; it is retained by the smallness of the flue throughout its whole length. It was necessary to observe, that in the defendants' machine there was three sets of tubes side by side; was not certain whether their specification said so, but that was the case in a machine which he had seen at Mr. Braithwaite's manufactory. In the plaintiffs' machine there was one large flat tube; in that of the defendants' three small circular ones side by side.[*] The fire in the defendants' machine was fed at the top by a magazine, having an entrance-door and an inner-door; just the same as in the machine he had seen at work at Mr. Galloway's manufactory, and the same as described in the plaintiffs' specification—*except that the valve was a horizontal one instead of a turning one.*[†] In short, both machines were essentially the same. There was a considerable difference in the proportions of them, but that was owing to the circumstance that the boiler he saw at Mr. Braithwaite's was for high-pressure steam, and that which is in use at Mr. Galloway's is for low pressure.

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[*] Which is evidently quite a different thing. We repeat, that there is not, in all the plaintiffs' specification, a single thing to show that they contemplated the gradual narrowing of the flue as a means of compression. The artful attempt of the witness to give that turn to what is said about regulating the area of *the valve*, speaks volumes on this head. The quickness with which Sir James Scarlett caught him in the act, detected, and exposed the misrepresentation, is deserving of all admiration.—ED. M. M.

[*] His lordship took, in one word, the right view of the case. How could that be called a valve in any sense of the term, which, according to the witness, was kept "constantly open?"—ED. M. M.

Cross-examined by Sir James Scarlett.

Do you know whether the plan of supplying a fire-place with air by a pump or a pair of bellows, is a new invention?—The plan of blowing in air is not new at all; I have known it myself to be often used for the purpose of making the fire burn intensely under a boiler.

Are you aware of a patent for a steam-engine that was granted, in 1812, to Messrs. Fox and Lean, in which they claim a right "to inject or force air through a pipe or pipes by any of the well-known mechanical means," &c.?—I remember reading that.

Then it is not new to inject air into the furnace of a steam-engine by a blower, bellows, or by any other means?—I never knew it practised except in models.

Is the compression of the smoke or heated air by means of flues, of various forms—is that a new invention?—No; it has been adopted in a great many steam-boilers.

The conducting of these flues through the water is also common?—Yes; it has become very common since steam-navigation has come into use, and it is found so advantageous that it is gradually making its way.

That method was in use before Lord Cochrane and Mr. Galloway's patent?—Yes, it was.

The restraining the exit of the heated air by narrowing the pipe is likewise very common?—Yes, it is very common.

There have been also, from of old, means frequently adopted of excluding the access of the air altogether for a time?—Yes, that is done by a sliding-damper, or a plate taken up and let down at discretion.

Any diminution in the area of a chimney will diminish the quantity of air that escapes?—Yes.

And the practice of making such diminutions is as old as making chimnies?

Lord TENTERDEN.—It is as old as hot-houses?—*Witness.* It has been followed in the case of steam-engines ever since the time of Mr. Watt.

In the machine you saw at work at Mr. Galloway's, was the chimney for the escape of the hot air and smoke, constantly open?—It is greatly contracted; it is not constantly open of the size of the flue.

If I were to ask you whether the flue of a hot-house of certain dimensions were open—you would not say—would you—that it was constantly open of the size?—It is *not* constantly open of the same size.

Mr. Farey, I believe there has been a mode not very long in use—for some years however—of making circular flues for chimneys which are made of bricks, placed perpendicularly; are you aware of that?[*]—Yes, Sir.

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[*] Mr. Farey is quite mistaken; what he took for three separate tubes were but the different bends of one continuous tube (see engraving, Mech. Mag. No. 389.) His accuracy in this particular is like that of a naturalist, who should say he had seen a dozen serpents one within the other, when he had only seen one in as many coils.—ED. M. M.

[†] Then according to Mr. Farey, a slide which draws out horizontally, or a door which opens and shuts in any position, is but a throttle-valve in a modified form. This, at least, is not the sense in which the word *valve* is commonly understood.—ED. M. M.

[*] Mr. Hiort's plan is, we presume, that alluded to.

And they may be made of any dimensions you please?—Yes.

And made so as to be gradually narrowed towards the top?—I was not aware that they were made gradually narrowing—they may be.

Now, in the machine which you saw at Mr. Galloway's was the fire fed in the way described in the plaintiffs' specification?—Not in the one I saw at work.

Do you conceive the plaintiffs' principle is to retain the hot air as long as possible?—Yes; to retain it till you get the heat out of it.

It is no part of his invention to make the exit of the air as rapid as possible?—It is an evil to have a rapid exit of the air.*

Then you consider it to be no part of the plaintiffs' invention to have the exit of the air as rapid as possible?—Rather the reverse. The object is to retain it and keep it in a state of compression.

Sir James Scarlett (to the Bench)—I have not been able to find out what Mr. Farey states to be new.

Lord Tenterden.—On this evidence there is nothing new except as regards the feeding of the fire.

Sir James Scarlett.—Which I can show to have been done by Mr. Watt, a long time ago.

Lord Tenterden.—It seems to me, that the valve is an essential part of the plaintiffs' specification, and that they do not use. I am of opinion I must call the plaintiffs.

Mr. Pollock. — Perhaps your Lordship will allow me to re-examine Mr. Farey?—(His Lordship assented.)

Mr. Farey *re-examined by* Mr. Pollock.

Is the valve, Mr. Farey, essential?—It is not essential.

What is there new in the plaintiffs' patent?—The arrangement whereby he retains the air in the furnace and flue under a state of compression—that is, not done by any one new thing, but by a combination.

Is the mode of furnishing the fuel new?—It is new.†

Is it essential?—It is essential to keep up the compression.

Is this plan of a chamber with two doors quite new?—Quite new to me; I have seen furnaces with double doors, but both open together.

Did you ever see before in any combination, old or new, compressed air applied in the way in which it is done in this furnace?—No; the plan of blowing air into the fire would not occasion compression; neither would the ordinary method of a damper produce compression, because the air is induced to escape from the draught of the chimney.

Did that patent of Fox and Lean's, in 1812, resemble this in any degree with regard to producing compression?—Certainly not.

Do you know of any other plan by which the compression necessary to give effect to the plaintiffs' invention could be obtained, except either by permanently contracting the extremity of the flue, or having a valve with a weight on it, or a valve with a column of water?—These are the three modes, but the contraction may be made through all the length of the flue, or made entirely at one end.

The blow-pipe, I think, is an instance of long-continued contraction?—It is very much contracted, at the end particularly.

Does the apparatus described in the plaintiffs' specification produce a similar effect?—Yes, certainly, it produces the effect combined of all three methods.

Lord Tenterden.—It appears to me, on looking at the whole of the patent of the plaintiffs, that it is an essential part of their invention, that the exit of the air which is forced into the flue, should be in some way prevented. This, they do, by means of a valve, kept down by a weight or a column of water. Now the defendants, instead of having any such valve, regulate the exit of the air by contracting gradually the tube or flue, or whatever you may call it, till in the end the air passes freely through and goes off the chimney. I think the two are methods essentially different—therefore, call the plaintiffs.

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Note Vindicatory.

After this case was disposed of in the Court of Chancery, by the refusal of Lord Lyndhurst to grant the injunction which the plaintiffs had applied for, we stated, that "we were never more satisfied with the justice of any decision," and this, not only for the reasons which appeared to have weighed with his lordship, but for many others, which an independent view of the case had suggested to our minds, and which additional reasons we set forth at considerable length. (See "Remarks," Mechanics' Magazine, No. 365, p. 382). We were much blamed by the plaintiffs and their friends, for taking so decided a part in an affair, which had still to undergo investigation in another Court; and we are willing to admit, that the course we took was an unusual one, and only to be justified by very peculiar circumstances. That there were such justifying circumstances, we shall now make, in a few words, abundantly apparent.

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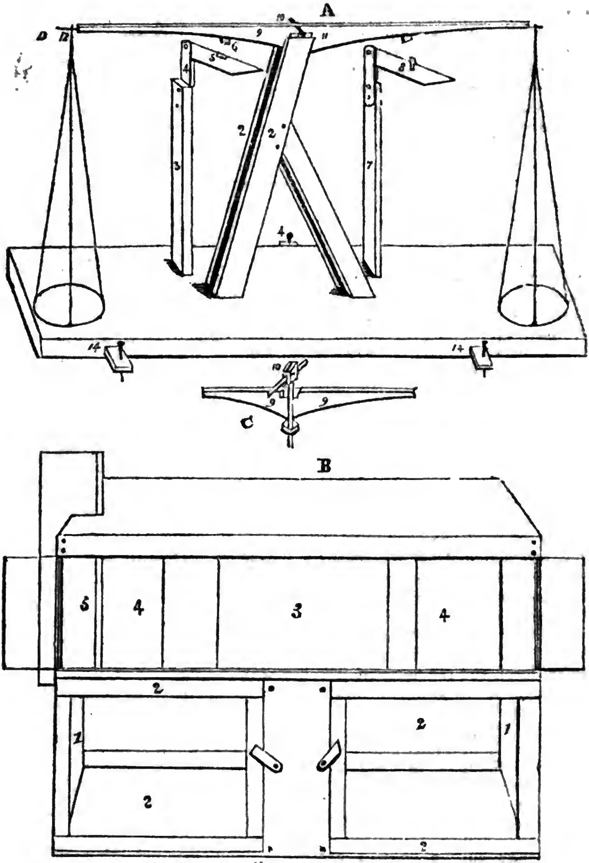
* How so, Mr. Farey? What use can there be in detaining the air a moment longer than is necessary to get the heat out of it?—Ed. M. M.

† How is this to be reconciled to Mr. Farey's answer to the previous question—there is not "any one new thing, but a combination?"—Ed. M. M.

The whole of the learned and scientific persons, Dr. Birkbeck, Mr. Perkins, Mr. Bramah, &c., who made affidavits in support of Lord Cochrane and Mr. Galloway's application to the Court of Chancery for an injunction, swore to this effect: that they had seen a steam-engine at Mr. Galloway's manufactory, doing all the business of that manufactory, which was supplied with a boiler "made and constructed conformable to, and in accordance with, the specification" of the plaintiffs. One of them (Mr. Joshua Horton, of Birmingham) even swore that it was "made *strictly* in accordance" with the specification. And that there might be no deficiency of numerical testimony to this effect, Mr. Galloway himself made oath that the engine, with the boiler, conformable as aforesaid, "had been viewed whilst working by upwards of five hundred persons who had witnessed its successful performance, and the great benefits resulting from its use." We pointed out in our "Remarks" a defect in this swearing which had not been noticed in the Court of Chancery; namely, that though all the witnesses swore the boiler was *made and constructed* conformable to, and in accordance with, the specification, not one of them swore that it was *worked* in the mode set forth in the specification. For example, the pipe Y, which the specification directed to be kept closed might have been left open, and the smoke and hot air might have escaped up that pipe, instead of going down through the column of water, as directed by the specification.

We consider, that the swearers were all very much obliged to us, for helping them to this flaw in the record; for, though they had not *literally* sworn that they saw the machine worked according to the specification, there can be little doubt, we apprehend, that they all *thought* they had seen it so worked, and *meant*, by their affidavits, to convey such an impression to the court and to the public. Now, what did we further point out? We demonstrated that the plaintiffs had failed in proving a use of their boiler in the mode set forth in their specification, simply because "*it is physically impossible so to use it*" (Mech. Mag. No. 368, p. 383). Other persons had said, that the invention of the plaintiffs was not likely to answer in practice; but the merit (such as it is, and it is not much) of showing that it must of necessity prove abortive, was ours. We do not say, there was nobody else knew as well as we did, that such a machine as the plaintiffs' would not work—there were the plaintiffs themselves who knew this perfectly well; but this we say, that while the plaintiffs were designedly and studiously concealing the fact from the knowledge of the public—inviting all the world (by public advertisement, if we recollect right) to come to Mr. Galloway's manufactory and see at work a machine constructed according to their patent, and getting many reputable individuals to swear that they had seen such a machine at work—we were the only persons who were at the pains to demonstrate to the public, that if the machine exhibited did really do the work of Mr. Galloway's manufactory, it could not possibly be a machine constructed according to Lord Cochrane and Mr. Galloway's patent. We saw a gross deception in the course of being practised on the scientific world, and knew of no reason that should induce us to refrain from instantly exposing it. A trial at common law was talked of, it is true, but what certainty was there that it would ever come on? Was it not more probable that the plaintiffs, *knowing what they did*, would let matters rest where they were? That they have not done so, but brought the case to trial, we are glad; for the result has been to establish incontrovertibly the truth of every thing we asserted. The evidence of the witnesses examined has proved, that in the case of the boiler exhibited at Mr. Galloway's manufactory, there was no valve at the end of the flue, loaded with water or any thing else; not only so, but that the plaintiffs never did apply a machine with a valve so loaded to any practical purpose. And the Lord Chief Justice is with us, in the opinion, that any machine, *not* closed with a valve kept down by a column of water, or some equivalent pressure, is *not* a machine "made and constructed conformable to and in accordance with the specification" of the plaintiffs.

DESCRIPTION OF A CHEAP AND DELICATE BALANCE.



Sir,—Having lately been occupied in making some experiments which required the use of a delicate balance, I attempted to put into practice the suggestions of Mr. Ritchie, as given in your useful and highly amusing publication No. 150. His excellent design, however it may combine economy and simplicity, I found impracticable, and my disappointment led me to reflect upon the principles

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* This paper is to be found in the Mechanics' Magazine, vol. vi., page 147, and should be consulted before perusing these observations.

on which the balance is formed; when I discovered that the ingenious inventor had overlooked some circumstances which were essential to the success of the instrument, and without which its great sensibility was of little avail. I found, also, that I could make what I conceived to be decided improvements in the balance itself, and at the same time could superadd other arrangements which would render the whole instrument more perfect in its construction, and more useful in practice. On these accounts I imagined, that my remarks might not be altogether without their value to some of your readers, especially as they are the result of much trouble and of much time.

I shall subjoin a brief statement of the facts to which I have alluded, and then simply describe the different parts of the instrument itself, as delineated in the wood-cut.

The method of double-weighing, which renders unnecessary the perfect equality of the arms of the beam, evidently presupposes that at each separate weighing of the substance and the weights, the beam and the index should maintain the same relative situation; that is, the knife should in both cases occupy *precisely* the same points on the glass cylinders. If the index be placed at the extremity of the arms in the way adopted by me, then (the beam being placed mathematically level) the pointer will of course always point to the same degree, at whatever part of the glass cylinders the fulcrum may be placed. But the trouble of finding this perfect level, and the necessity it afterwards involves of weighing always to the same line, are disadvantages which will lead to the abandonment of this plan. Constructed, however, as Mr. R.'s instrument is, with the index-card below the beam, it appears to be indispensably necessary that when the body and the weight are separately weighed, the knife be placed precisely on the same points. This important requisite Mr. Ritchie seems entirely to have overlooked; and he has formed his balance without making any provision for the accomplishment of this object.

The plan which I have adopted will I think be found simple and effective. It is simple, for it consists merely of one upright piece of wood, supporting an iron arm, working in a socket, on which a piece of brass with a slit in it is allowed to fall. It is effective, because the pointing-needle can be brought infallibly to the same line on the index for any given number of times; and since $\frac{1}{100}$ part of a grain will move the needle through nearly $\frac{1}{2}$ or $\frac{1}{3}$ of a degree, (according to the weight in the scale), this precision will perhaps be deemed very considerable. Among the improvements made in the beam itself, I would first mention the capability of moving the knife, which enables the experimenter to find out most easily the centre of gravity, whatever be the peculiar shape of the beam. In practice, while the situation of the centre of gravity in a beam of a regular shape is soon discovered, yet in beams of an irregular construction this is not the case. Besides, what is the centre of gravity of the beam when the scales are loaded with light weights, ceases to be so with heavy ones. With 20 or 30 grains the centre of gravity may be brought to be very nearly on a perfect level with the points of suspension: if, however, the number of grains be increased to 200 or 300, the centre of gravity will be raised above the fulcrum, and the tendency of the scales will be to *set*.* The centre of gravity must be be higher or lower, according *to the weight which the scales are to carry*.

The capability which my beam possesses of carrying both light and heavy weights, is, I conceive, an improvement upon Mr. Ritchtie's beam.

Another advantage to be derived from this adjusting-fulcrum is, that we can obtain, in each case, the *maximum* sensibility of the scales.

We know that the delicacy of the scales depends upon the relative situations which the centre of gravity, the fulcrum, and the points of suspension, bear to each other. If the centre of gravity be *below* the fulcrum, the oscillations of the balance when produced are quick, but soon cease, and a weight comparatively great is necessary to turn the beam.

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* Some have explained the setting of the scales as dependant upon the positions of the fulcrum below the points of suspension. That this, however, is not the general solution of the fact, is evident from an experiment which may be made with a beam constructed upon Dr. Black's principles. Here the fulcrum and the points of suspension all lie in the same right line; and yet the same effect is produced by the addition of weights. Since the fulcrum is, in this instance, confessedly *not below* the points of suspension, the centre of gravity must be *elevated*, and therefore capable of giving the preponderance to either.

These effects are more or less marked as the centre of gravity is more or less depressed.

If the centre of gravity be raised until brought in the *same right line* with the fulcrum and points of suspension, the beam is capable of being moved with the smallest weight. Its oscillation now no longer exists, because the beam has no tendency to any particular position, but will rest in any.

If the centre of gravity be raised *above* the fulcrum and points of suspension, the effects of *setting* already alluded to are produced.

In practice it is found best to put the centre of gravity a little below the fulcrum in order to obtain as much sensibility as is compatible with a properly-marked vibration.

These remarks upon the positions of the centry of gravity, trite as they are and superfluous, undoubtedly, as they will be to many of your readers, will nevertheless be extremely useful to that class of persons most likely to avail itself of the suggestions here given.

A clear understanding of these fundamental truths by affording the rationale of the adjusting of balances, will become on all occasions the most efficient guides to amateur mechanics. They will now easily understand how the maximum capabilities of the scales which form the subject of this paper are soon discovered, whether the scales are to carry small or large weights.*

Let the knife be at first raised decidedly too much, having previously put into the pans the quantity which the operator usually employs. The knife is then gradually to be screwed down, and as this is depressed, the beam will be found to turn with less weight. This depression may be continued as long as *the index needle, after vibration, always returns to the same line on the index.* At this point we must stop, since beyond this the centre of gravity will be brought so nearly in a line with the fulcrum and the points of suspension, that the beam will be found to come to rest in more positions than one.

I am quite aware, that the plan is in principle recognised by philosophical instrument makers, but the means they employ are very different. They attach to the index-pointer, placed *below* the beam, and at right angles to it, a *moveable* brass ball. When, therefore, the beam varies from its horizontal position, it has to overcome the gravitating power of the ball and the pointer, and consequently its oscillations have been prejudicially influenced in the ratio of the weight and its appendage.

From objections of this nature my mode seems exempt.

Instead of putting knives, on which to hang the pans, as proposed by Mr. R., I have adopted what is more simple. I merely insert into the ends of the beam, the upper halves of two small needles placing their eyes horizontally. The three strings of the pans are made to merge into one, and this one passing through the eye is knotted at the end. By this means, we save the friction arising from the contact of the silken threads themselves as well as the friction of the silk thread and the sides of the needles.

Mr. Ritchie's plan undoubtedly produces a far more sensible balance, but experiment, the grand test of every truth, has shown me that my mode, with much less trouble, is capable of affording sensibility and accuracy quite sufficient.

The scales were loaded with nearly 260, say 250, grains, in each pan, and on the addition of $\frac{5}{1000}$ part of a grain, they were so sensibly affected as to make the pointer move through nearly one quarter of a degree. Now, 250 grains divided by $\frac{5}{1000}$ part of a grain, or $\frac{250}{1} \div \frac{5}{1000} = \frac{1}{250} \times \frac{5}{1000} = \frac{5}{250,000} = \frac{1}{50,000}$. They, therefore, can weigh to the fiftieth thousandth part of the weight in the pan, and can, consequently, be well trusted to *four places of decimals.* This delicacy may be considered quite enough for the purpose of experimenters generally.

The adoption of three common screws for adjusting the level of the glass cylinders, on which the knife of the beam works, is at least economical, and renders unnecessary all that great care and trouble in the construction of the wood part which the level of the two supporters would otherwise have demanded. T some other contrivances added to the instrument, but these will be seen when each part is referred to in the wood cut, and therefore need not be alluded to in this place.

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* As the beam is quite independent of the rest of the instrument, and so easily made, it is best to have two beams—one to weigh up to two hundred and fifty grains, and the other greater weight.

The construction of the balance, and its case requires very little skill in the use of the chisel. I have been able to complete the whole without any assistance, although I have never served an apprenticeship with any of the useful fraternity of carpenters. The expences incurred have amounted only to 4 or 5 shillings; while a balance of equal delicacy cannot be purchased at the shops for less than 15 guineas.

Description of the Engravings.

Figure A.

1—The stand board may be about 13 inches in length, and 4½ in breadth.

2—Double bearers morticed into the stand, are seven inches high, and about ·9 (nine-tenths) of an inch in breadth, and ·3 inches in thickness.

3—Support, morticed into the stand, and which with

4—The iron arm working in a socket, tightened at pleasure by a screw, is 6¼ inches high, which any common blacksmith can make.

5—Part sharpened, on which is to fall

6—Piece of brass with a slit in it. The brass is let into a piece of wood, and the wood glued to the beam.

7—Another support with an iron arm, &c., precisely similar to Nos. 3 and 4. Its object is to move the beam when the scales are in the case.

8—Piece of wood astride the arm, which allows the arm to be placed farther from the beam to afford it more play. In practice it is found advisable to divide the piece, and to glue a half on the beam as in the cut.[*]

9—Beam of light wood, 8·3 inches in length, and ·15 of an inch in thickness, ·4 of an inch in depth in the middle; through which a hole is made to receive the screw of the fulcrum, and tapering off at each end. The shape of this beam differs somewhat from Mr. R., and will, perhaps, be thought an improvement upon it.

10—The knife: this is given on a larger scale, in Fig. C, and all its parts will be so evident on inspection as not to require any written description. It has a small brass nut working upon a fine-thread screw, and the way which the knife is fastened to the screw, allows the knife to be put perfectly at right angles with it, before the last clenching of the little pin. I have found that a penknife, from the dissimilarity of its sides, was not well calculated for this purpose. The one used in my scales is a part of a larger knife cut out by a file.

11—Two pieces of thermometer tubes, ·7 of an inch in length. These can be cut off by first filing a tube quite round, and then gently striking it. I have fastened the tubes by fine wire.

12—Upper halves of needles with their eyes placed horizontally, inserted into the ends of the beam.

13—The pointing-needle which, after having been dipt into the glue-pot may be laid upon the top of the beam. If the scale attached to the case be ivory, I should advise that the colour of the needle be altered by putting it for a few seconds into a solution of bi-sulphate of copper (the blue vitriol of the shops.)

14—Three common iron screws for adjusting the level of No. 11, passed through pieces of wood morticed into the side of the stand. The ivory scale, by means of a thread with a large shot attached to it, will serve as the *level* for this purpose.

Figure B.

This sketch contains the case for the scales, which is *absolutely necessary* for delicate weighing.

1·1·—The two sides are made of thin board. The back and the top are covered with silver paper, rubbed with a fixed oil: lamp oil may be used. This covering is at once cheap, light, and semi-transparent.

2·2·—Two glass doors which, when open, allow access to the pans.

3·4·4·—Glass capable of sliding in any way, or of being taken out altogether, when any thing is required to be done to the beam.

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[*] As connected with the parts from Nos. 3 to 8 inclusive, I would here, in a note, subjoin one remark. In order to place the beam still more precisely under the same circumstance, when the weight and the substance are separately weighed, I always lower the arm on the left, so as to allow the pointing needle to reach on the ivory scale some particular degree. The doors and slides being closed, the beam is raised by means of No. 8, and the brass, No. 6, is made to fall on No. 5 The right arm is then suddenly lowered, and the beam allowed to oscillate freely. By this management, the *momentum* of the scales is in both cases rendered equal.

2 occupies the space between 5 and 8, in the sketch A, and Nos. 3·3 on either side of the iron arms which protrude beyond the case in ¼ or ½ an inch.

The moveability of these is constantly necessary during the process of double weighing, and for the purpose of placing the beam correctly.

These divisions of the glass are economical as well as convenient.

5—The ivory scale passed through an opening in the wooden side, and capable of being moved at pleasure along the edge of which the pointing needle travels.

I have the honour to be,
Sir,
Your obedient servant,
AN UNDER-GRADUATE OF THE UNIVERSITY OF CAMBRIDGE:

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THE TIDES.—THE OTAHEITE PHENOMENON.

Sir,—It was with mingled feelings of astonishment and perplexity I read the last communication (No. 420) from your old and very able correspondent O. C. F. relative to the singular law by which the tides at the island of Otaheite are regulated, namely, that the time of high-water *is precisely at noon and midnight all the year round.*

Kotzebue, who visited the island only a few years ago, was it seems the first to communicate to the world this astounding anomaly. O. C. F. himself seems not to have at first attached much credit to his statement; he no doubt thought that the young Kotzebue (like his father, the celebrated Kotzebue) might sometimes wish to amuse his readers with a little of the marvellous. But O. C. F.'s doubts appear to have been removed by information he has subsequently obtained from Mr. Bennett, who visited the island of Otaheite as one of the stations of the London Missionary Society, and who fully confirms what Kotzebue has asserted. But, Mr. Editor, although I have no wish to impugn the veracity of Mr. Bennett's statement, still I must confess I have some misgivings on the subject. Indeed, it would require something more than ordinary testimony to believe a statement which, if true, would go a great way to overturn the theory of *universal gravitation!*

The island of Otaheite is situated nearly in the middle of the great Pacific Ocean, in 17½ south latitude and about 80 degrees of longitude, in the same parallel of latitude from the western shores of South America, and about 60° from the east coast of New Holland. There is no continent directly south of it; and on the same meridian towards the north it is distant about 77° from North America. So that of all the islands in the terraqueous globe, there is none where all the forces that produce the tides have more room to operate; consequently, the period of their return ought to mark the time with the most undeviating regularity—or the time from one high water to the next, at a mean for a whole lunation, ought to be 12 hours, 25 min. 24 sec. Kotzebue and Mr. Bennett assert that the period at Otaheite is only 12 hours. Well, if this should really be the case, the moon cannot be the primary cause of producing the tides at the island of Otaheite: or, in truth, (which might be easily demonstrated) the moon can have no influence whatever in raising the water at the said place. Therefore, if the moon be the primary cause of raising the water in the ocean at every other place in the globe except the neighbourhood of the island of Otaheite, we must suppose that the moon in passing the meridian of some place in west longitude must cease to gravitate!! Otherwise the whole theory of the tides would seem to be founded on a suspicious foundation.

I should wish to be informed what law the tides follow in some of the adjacent islands, and the heights they rise during the different periods of a lunation?

The island of Otaheite, it appears, was first discovered by Captain Wallis in 1767. In 1769, it was visited by the celebrated Captain Cook, accompanied by Dr. Solander and Sir Joseph Banks. An accurate survey of the whole island was made by them. It has since been visited by hundreds of navigators from all quarters of the Old and New World, and yet it would seem that none of them (except Kotzebue) have condescended to notice this wonderful phenomenon, though it is of a nature to attract the notice of the most careless observer! *Credat Judæus—non ego.*

Yours, &c. G. S.

Aug. 30, 1831.

STEAM NAVIGATION.

The *United Service Journal* for the present month, contains a second letter from Captain Basil Hall, on preventing accidents by steamers; in which he suggests, that besides removing the place of steering to the bow of the vessel, the direction of the machinery should be placed under the independent control of the captain or pilot, by means of the index machinery invented by Messrs. James and Charles Carmichael, and used for several years past in all the steam-boats on the river Tay. A description of this machinery, illustrated by an engraving, was communicated to us by Captain Hall, five years ago, and it appeared in the 104th number of the Mechanics' Magazine, to which, therefore, we refer our readers. As the account given of it in Captain Hall's present letter, however, is mixed up with much new and useful information on the subject, we think it proper to lay it also before our readers—omitting only some introductory paragraphs.

"The purpose intended by the contrivance to which I wish to call the attention of the proprietors of steam-boats, is a device for enabling the captain or pilot to command the motions of the machinery without reference to the engineer, and without that eternal uproar, delay, and uncertainty, which now occur on board most steam-boats. The pilot in the bow has to roar out to the captain on the paddle-box, who bawls to the engineer below, either to "Stop her!" or to "Back her!" or to "Go on!" By this process much time is lost—which may prove fatal to little boats in the way—and it will often happen that mistakes arise, from the captain or the engineer not understanding each other, or not distinctly catching the sounds of the pilot's voice. In dark, rainy, or blowing nights, you may easily conceive how these difficulties are increased, and how very uncertain the movements of a steam-vessel are, regulated by the methods now in use. Even in broad day-light and in fine weather, we all know that accidents are perpetually occurring, and I conceive that most of these may be prevented by the adoption of the plan of steering in the bow,' suggested in the U. S. Journal of August, with the addition of that I am about to describe.

"In all the steam-boats on the river Tay, the machinery is so fitted, that by the simple motion of a small handle or index, *placed on deck*, in hearing and in view of the pilot or the master of the vessel, every movement which the engine is capable of giving to the paddle-wheels, may be at once commanded, without reference to the engineer.

"The vessel may be advanced, or backed a-stern; or she may be merely checked in her velocity, or be entirely stopped, at any given moment, by merely turning, with a slight effort of the hand, a horizontal bar, about two feet long. This bar is connected with a dial plate, furnished with a small hand, like that of a clock, to tell whether the machinery is so placed as to urge the boat a-head, or or a-stern, or to stop her.

"No skill, it may be observed, is required for the management of this hand-gear, so that the master or the pilot, or whoever has charge of the boat, or any one of the sailors under his directions, can perform the office of regulating the movements of the steam-machinery as well as the most experienced engineer. In point of fact, the engine-room in the Tay steam-boats is generally locked up, and I have been in one of them for many hours, during which the vessel was set a-head, stopped, and backed, a dozen times, without the engineer once going near the machinery. Thus, the confusion which so frequently arises at night in calling out to the engineer below, is avoided; and all ambiguity arising from the word of command being transmitted through several hands, is prevented.

"It is very material to observe that this ingenious invention places the steam-engine as completely under the command of the pilot as the rudder is proposed to be; and as there is no reason why it should be fixed on one part of the deck more than another, I would strongly recommend its being, placed alongside of the wheel, on the top of the scaffolding near the bow, so that the pilot might have not only the power of steering the boat with certainty, but of regulating all her movements with the utmost degree of promptitude.

"It may be observed, that as it is quite impossible two persons can steer one ship well, so two persons cannot effectually regulate the motions of her machinery. If the pilot in the bow be obliged to call out to the steersman abaft, even though his voice is so loud and distinct as to require no one to pass the word along, still there is inevitably a great loss of time in the transmission of his wishes to the mind of the helmsman—who, if stationed abaft, sees nothing, and must act by guess-word—and there is a still further loss of time before the steersman can impart to the rudder the required motion. Accordingly, it is of vast importance in the steam navigation, of rivers especially, that the pilot who stands in the bow of the vessel would have the means *literally in his hands*, of giving instantaneous changes not only to the direction of the boat, but to her rate of moving. This object he will now, I trust, have, by the general adoption of the American method of placing the steering-wheel on a platform, far forward, and high above the deck; and I may here repeat what I said in my former letter to you, that on the great American rivers the pilot himself always steers the boat himself with his own hands.

"If the steam hand-gear above-described, be in like manner placed within the pilot's reach—which it may perfectly well be—both the force and the direction of the boat will be always under the complete management of one and the same man. I cannot but think that the utility of thus centering all the power in the person who has all the responsibility, must be obvious to every one who has considered such subjects attentively; and I do earnestly hope, that all the steam-boat proprietors on the Thames will, ere long, adopt both these suggestions.

"In the mean time, it affords me the highest satisfaction to be able to authorise you to state, that the Comptroller of the Navy, Sir Byam Martin, has given directions for one of the Government boats to be fitted up with the apparatus for steering in the bow; and I have not the least doubt that the utility will be so obvious, that the plan will be imitated by every other boat in a short time.

"I may add one word on the general topic which interests the public very much at this moment,—I allude to the danger to coal barges and to little boats from these vessels going at too great a rate. The idea, however, of imposing, by law, any restriction on the progress of such an improvement as that of steam navigation, appears quite preposterous.—Speed and certainty are the life and soul of a steam-boat, and therefore, to regulate her pace is actually to tie her feet in the race, and totally to destroy her superiority over the old sailing vessels. If overloaded coal-barges are liable, as it is alleged, to be swamped by the steam-boats' wave, they must either be less loaded, or they must be fitted with higher gunwales; and if wherries, with five or six passengers on board, are liable to be sunk by the same cause, the watermen must either take fewer passengers at once, or they must charge higher for the risk, or they must learn to be more expert in keeping out of the way. The steam-boats ought undoubtedly to be forced to take every proper precaution,—but to regulate their speed, and to say they shall go only so many knots an hour is manifestly out of the question, and would strike at the very root of this grand invention."

NEW WEIGHTS AND MEASURES.

Sir,—Agreeable to the late Act of Parliament for the regulation of weights and measures, we have the following directions, viz.:—

Divide the length of a pendulum, which vibrate seconds at London, on a level with the sea, in a vacuum; or, the distance between the axis of suspension, and the centre of oscillation, into 391393 equal parts. Then will 10000 of those parts be an imperial inch. Take a cubic inch of distilled water at a temperature of 62 degrees of Fahrenheit's thermometer; let this be weighed by any weight, and let such weight be divided into 252458 equal parts, then will 1000 of such parts be a troy grain; and 7000 of those grains will be an avoirdupois pound, the operation having been performed in the air. Ten such pounds, or 70000 troy grains of distilled water, at 62° of temperature, will be an imperial gallon, containing 277,274 cubic inches. An imperial pint will, therefore, contain 1¼ lbs. avoirdupois, or 8750 troy grains of distilled water, or 34,65925 cubic inches.

Now, it follows from the above abstract that a cubic inch of distilled water weighs 252,458 troy grains; consequently, a cubic foot of distilled water at 62° of temperature, weighs 997,137 avoirdupois ounces.

Hutton's Course gives distilled water =1·000 at 40° of Fahrenheit. Gregory's Mechanics gives rain and distilled water each=1·000. The Library of Useful Knowledge gives distilled water = 1·000. Barlow's Mathematical and Philosophical Dictionary also gives rain and distilled water each = 1·000. The above highly-respectable authors make no distinction between the specific gravities of rain and distilled water.

Tate, however, in his Elements of Commercial Calculations (1819) page 206, gives rain water = 1,000, distilled water = ·993; this is the only table that I recollect to have seen, that makes any distinction between the specific gravities of rain and distilled water. The specific gravity of the latter is, however, erroneous, as will appear from the following deductions.

According to *Biot's* Formula, the greatest condensation of water obtains at a temperature of 2°·736 of Reaumur's, or, 38°·156 of Fahrenheit's Thermometer.

Biot's Formula for the expansion of water, is as follows:

$$-0{\cdot}0000544878\,\mathrm{T} + 0{\cdot}0000101395\,\mathrm{T}^2 - 0{\cdot}000000027080\,\mathrm{T}^3 + 0{\cdot}000000000000\,\mathrm{T}^4.$$

T being the degrees of Reaumur's Thermometer. Now, as the density, or specific gravity of water is nearly equal to the reciprocal of its volume; the following table of specific gravities computed from the above formula, will show that a cubic foot of distilled water can never, at any temperature, weigh 1000 avoirdupois ounces.

Fah. Thermometer.	Spec. gravity.
32° . .	0·999925
38°·156 .	1·000000
44°·359 .	0·999925
62° . .	0 998994
212° . .	0·955410

Now, the specific gravity, or density, of water, at 62° as above, is ·998994; the specific gravity at the point of its greatest condensation being unity. And, as I have shown, that the weight of a cubic foot of distilled water, at a temperature of 62° of Fahrenheit, according to the late Act of Parliament, is 997,137 avoirdupois ounces: We have, therefore,

as 998,994 : 997,137 :: 1000,000 : 998,141.

Hence a cubic foot of distilled water at the point of its greatest condensation weighs only 998,141 avoirdupois ounces!

It is, therefore, I think to be regretted that 1000 avoirdupois ounces was not made equal to a cubic foot of distilled water. Or, that rain water was not substituted; as Tate informs us, (p. 205) that a cubic foot of *rain* water weighs *exactly* 1000 ounces avoirdupois at a temperature of 60° Fahrenheit's thermometer; other substances and liquids are generally compared with it, and their *specific* and *absolute* gravities become thus identified.

A cubic foot of such water would weigh 437,500 troy grains; an imperial pint would contain $34\frac{14}{25}$ cubic inches; an imperial gallon $276^{1\,2}$ cubic inches; and the standard bushel $2211\frac{21}{25}$ cubic inches (precisely); each measure of water weighing $1\frac{1}{4}$, 10, and 80 pounds avoirdupois respectively. Which assimilation is, I think, much more simple than that which has been adopted.

Yours, &c. J. UTTING.

Lynn Regis, Aug. 24, 1831.

P. S.—The most eligible point of temperature at which to fix the standard of weights and measures, is perhaps the point of the greatest density of water, or 38° · 156 of Fahrenheit's thermometer. The variation of density for one degree above or below this temperature is about 45 *times less* than the variation for one degree above or below a temperature of 62°; so that an advantage is obtained in ascertaining the specific gravities of bodies in the case of immersing them in water of the temperature of about 40° (as various opinions are entertained as to the point of greatest condensation, some authors fixing it at 42°½) inasmuch as the density of water is subject to much less variation for this than for higher temperatures.

That a cubic foot of water at a temperature of 40° should weigh precisely 1000 ounces, and that the greatest density of water should also take place at this temperature, are circumstances very remarkable, and seem to indicate that the avoirdupois ounce was obtained from the one thousandth part of a cubic foot of water. But whether the ancients were acquainted with this circumstance, and whether they had any knowledge respecting the temperature at which water obtains its greatest density, are circumstances that will probably for ever remain unknown to us.

J. U.

[Mr. Utting informs us, that the preceding communication was written previous to his seeing the letter which appeared from Trebor Valentine on the same subject in No. 419.—ED. M. M.]

RECOVERY OF A PORTION OF THE TREASURE SUNK IN THE THETIS.

(*Extract of a Letter from a Naval Officer at Rio, dated May* 16, 1831.)

The difficult and hazardous enterprise in which Captain Dickinson, of the *Lightning*, has been for some time engaged, has been attended, I am happy to say, with tolerable success. The circumstances which led to this attempt, with its results to the present date, may be interesting to you. When the news of the loss of the late *Thetis* arrived at Rio Janeiro, Captain Dickinson had just returned from the Pacific with a freight of 450,000 dollars, and was in daily expectation of receiving orders to repair thither again. It, however, occurred to him, that the possibility of recovering some portion of the sunk treasure was worth considering, and although it was the general opinion that it was irrecoverably lost, his opinion was different, and he went to the Admiral and offered his services to attempt to get it up. The Admiral immediately accepted the offer, and gave him a sort of *carte blanche* to make what preparations he might think necessary. With the prospect of another trip to the Pacific, whence he would certainly have returned with another freight, many of his friends thought him wrong, while others considered it a mad project without a chance of ultimate success. Captain Dickinson, however, thought otherwise, and, as things have turned out, he seems to have had good ground for his opinion; and, accordingly, having determined on his mode of operation, he sailed for Cape Frio in the *Lightning*, where he arrived on the 30th of January. It would scarcely amuse you to enter into a detailed relation of all his proceedings; I shall, therefore, merely confine myself to saying that, not having such a thing as a diving-bell or any other instrument at all suited to the purpose, Captain Dickinson constructed one out of two of the metal water-tanks belonging to the ship, and this machine has been found to answer the purpose admirably. He also erected a large derrick from the base of the cliff, which extends 178 feet over the sea, and from which the diving-bell is worked. He has no little reason to be proud of this arrangement, as it is considered by all the naval men who have seen it, as a most extraordinary piece of practical seamanship, and a very good specimen of mechanism. The undertaking is one of great danger and difficulty, and his exertions have been laborious and unremitting. He has already succeeded in recovering property to the value of about 100,000 dollars. He is now removing some huge masses of rock which have fallen in where the wreck is. Every part of the ship is entirely broken into such small fragments, and they are so scattered about, that no estimate can be formed of the probable amount which he may be able to recover. He is, however, exceedingly sanguine, and his own personal efforts and exertions are not spared in endeavouring to ensure success.—*United Service Journal.*

PISTOL EXTRAORDINARY—ONE HUNDRED AND TWENTY BALLS PER MINUTE.

Mr. Wilkinson, the gunmaker of Pall Mall, has invented a pistol, of the capabilities of which he gives the following *almost* incredible account:—

"1st. It can be loaded and fired 10 times in 1 minute, projecting at each discharge 12 missiles in one horizontal line, diverging laterally from 12 to 18 feet, and within an elevation of 6 feet, at the distance of 30 or 40 yards. Each man discharging 120 missiles per minute, 100 men in 10 minutes are enabled to discharge 120,000 missiles, each equal in effect to an ordinary pistol-ball. Suppose that a squadron of 100 men charge an enemy's squadron of equal numbers, and that 75 direct their aim so badly, that not one of their missiles took effect, there still remains 300 well-directed bullets at the first discharge; or even imagine it possible that only 1 in 100 was efficient, 100 men in 10 minutes could put 1200 *hors de combat*. 2nd. A short carbine, capable of being discharged with the same rapidity as the pistol, but propelling 16 instead of 12 missiles, and particularly applicable to naval warfare, as 50 men directing their fire on the enemy's deck, while the fire of 50 more was directed against the men up the masts and rigging, would in 1 minute pour a shower of 16,000 missiles over the whole vessel, thus rendering her defenceless, and the boarding and capture consequently easy and almost instantaneous."

INTERIM NOTICES.

Communications received from Jasper—Mr. Baddeley—S. P.—Fabricius—Mr. Emsdale.

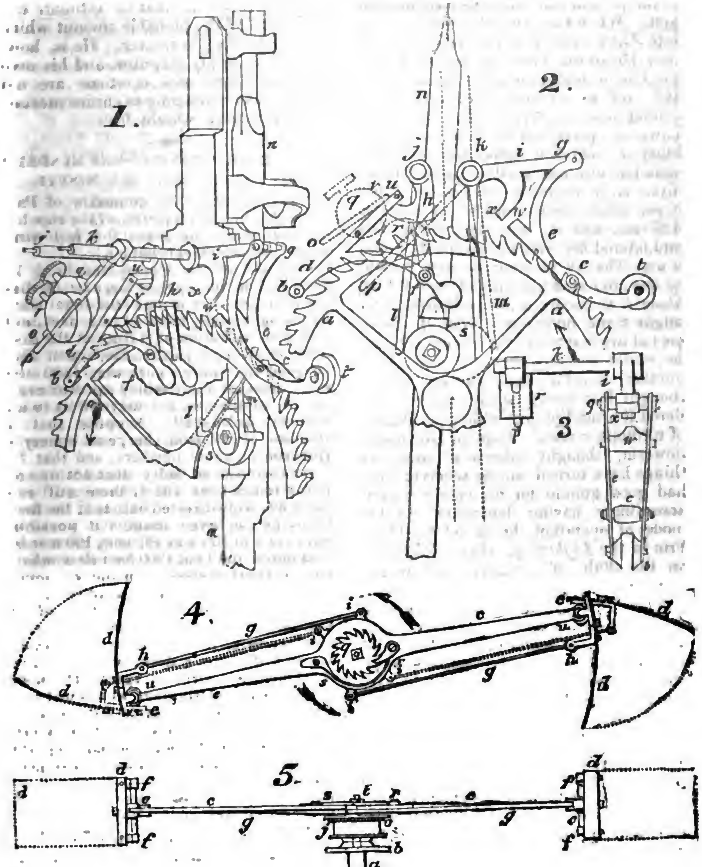
LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office Court Fleet Street.
M. SALMON, Printer, Fleet Street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 423.] SATURDAY, SEPTEMBER 17, 1831. [Price 3d.

MR. HARRISON'S ESCAPEMENT AND FLY FOR TURRET CLOCKS.



MR. HARRISON'S ESCAPEMENT AND FLY FOR TURRET CLOCKS.

In the course of the discussion which took place some time ago in our pages respecting Mr. Wynn's improvements in Church Clocks, and in which discussion, our esteemed correspondent, Mr. Harrison, of Barton-upon-Humber, took a principal part, allusion was repeatedly made to an improved escapement and fly of Mr. H.'s own invention; of which, however, no particular description was given, owing—as it now appears, to both improvements being at the time in the course of being submitted to the Society of Arts, by whose rules, no prize can be awarded to any thing, of which a description has been previously made public. The society have since awarded to Mr. H. their large silver medal and ten pounds for his escapement, and the silver Isis Medal and five pounds for his fly; and we are happy to have it now in our power, to extract from the last part of their Transactions, the following very distinct and lucid description by Mr. H. of the two instruments.—Ed. M. M.

OF THE ESCAPEMENT.

"The principle on which this escapement acts, is that of a small weight being raised by the wheel which, in descending, urges the pendulum—hence the pendulum is always urged by an equal force. The pallet, which the wheel thrusts higher, being heavier than is necessary for maintaining the motion of the pendulum, is partly counterbalanced by the small adjusting weight on the arm, which descends by the action of the wheel; and the pallet, which the wheel pulls lower, is also partly counterbalanced by a small adjusting weight on the other arm, which ascends by the action of the wheel. By means of those small weights, the maintaining power is so regulated as to give the pendulum a suitable oscillation.

"If we take a view of the acting of these pallets, it will be seen that their effect is nearly uniform, although the force of the wheel should vary considerably. As they *roll* instead of *slide* in and out, the friction, of course, is considerably lessened, and, consequently, the effect of any variation in the force of the wheel on the discharge is less. As some friction, however, still remains, it follows that, as the force of the wheel is greater, the resistance to the discharge will also be somewhat greater, and *vice versa*. But to this irregularity there is a very apposite and almost simultaneous counter-action: for as the pendulum must needs lift the pallets in discharging them, so do the ends of the teeth press harder or easier under the rollers of the pallets, thereby lifting a little more or less of their weight off the pendulum the moment afterwards; so that, although it is more or less checked by the discharge, it is, at the same time, more or less assisted in lifting the pallet the next instant; and so nearly do these counteract each other, that the motive force may vary very considerably before the pendulum is sensibly affected, as may be seen in the model herewith sent, by increasing the maintaining weight hanging at the works, and observing the arc which the pendulum describes a few hours afterwards.*

"But it is not merely *the arc described by the pendulum* which remains nearly the same, but also *the time in which the oscillations are performed*. If any variation in the discharge (which is *at the end* of the swing) were compensated by a difference in the urging force *at the beginning*, then of course *the time* must needs be altered, although *the arc* continued the same; but this is not the case —the check of the discharge, and the aid afforded, not only both vary from the same cause, and are nearly equal or compensate each other, but they are likewise both at the end of each swing, so that *the time* as well as *the arc*, remain nearly the same.

"Church clocks being unavoidably exposed to much greater difference of temperature than house clocks, and, besides, often having large dials, the works of which are much exposed, very great irregularity in the acting of the pallet wheel must inevitably arise from the oil becoming either more fluid or more glutinous by difference of temperature; but the pallets of my escapement are peculiarly adapted to obviate these and any other irregularities (occasioned either by the wind blowing against large pointers, or any other cause) by which the motion of the pendulum may be disturbed. And as they act on the recoiling principle, though without causing the wheels to re-

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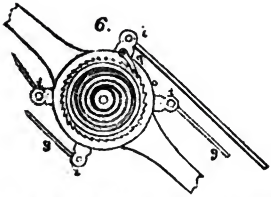
* The pendulum bulb being very light, is consequently liable to be much more affected by any additions which may be made to the weight, or by any variation in the density of the atmosphere, or by the air being agitated by people moving briskly near it, &c., than if it were of a suitable size for the escapement, which is sufficient to carry a bulb of forty pounds.

The length of the pendulum is merely suited to fix the model at a convenient height, without regard to any particular time of oscillation.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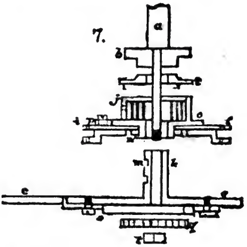
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trograde, the effect of any variation in the density of the medium, by which the swing of the pendulum might be more increased or diminished than it ought to be, is in a great measure compensated; and, consequently, its oscillations are thereby rendered the more nearly isochronous.

"That an alteration in the weight hanging at a clock affects both the range and the time of oscillation of the pendulum, is a fact generally known; but in the model which accompanies this paper nearly half as much more as the present maintaining weight might be added with very little effect either on the range of the pendulum, or the time of its oscillations, notwithstanding the extreme lightness of its bulb.

"The following are two rates of a clock in Christ Church, Hull, made by my son, with this improved escapement:—

"*Rate of Christ Church Clock, from October* 1 *to November* 9.

"*Note.*—The abbreviation *obs.* shows the days on which astronomical observations were obtained, and the clock was slow or fast of mean time, as under:

		min.	sec.	
October 1	obs.	0	19	slow.
2	..	0	18	..
3	..	0	17½	..
4	..	0	17	..
5	..	0	16	..
6	obs.	0	15	..
7	..	0	14½	..
8	..	0	13	..
9	..	0	12	..
10	..	0	12	..
11	..	0	11	..
12	..	0	9	..
13	obs.	0	8	..
14	..	0	6	..
15	..	0	5	..
16	..	0	3	..
17	..	0	3	..
18	..	0	2	..
19	..	0	2	..
20	..	0	1	..
October 21	..	0	2	slow.
22	obs.	0	0	..
23	..	0	1	fast.
24	..	0	2	..
25	..	0	2	..
26	..	0	3	..
27	..	0	5	..
28	..	0	7	..
29	obs.	0	7	..
30	..	0	8	..
31	..	0	9	..
November 1	..	0	9	..
2	..	0	9	..
3	..	0	8	..
4	obs.	0	7	..
5	..	0	8	..
6	..	0	8	..
7	..	0	9	..
8	..	0	10	..
9	..	0	11	..

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		min.	sec.
March 12	obs.	1	5
13	..	1	4
14	..	1	2
15	..	1	2
16	obs.	1	1
17	..	1	0
18	..	1	0
19	..	0	58
20	..	0	57
21	obs.	0	56
22	..	0	54
23	..	0	52
24	obs.	0	52
25	..	0	53

			min.	sec.
	26	..	0	52
	27	..	0	51
	28	..	0	50
	29	..	0	49
	30	obs.	0	48
	31	..	0	47
April	1	..	0	45
	2	..	0	45
	3	..	0	44
April	4	..	0	43
	5	..	0	41
	6	..	0	40
	7	obs.	0	40
	8	..	0	39
	9	..	0	37
	10	..	0	36
	11	obs.	0	36
	12	..	0	35
	13	..	0	34
	14	..	0	33
	15	..	0	32
	16	..	0	32
	17	obs.	0	31
	18	obs.	0	30
	19	..	0	30
	20	..	0	29
	21	..	0	26
	22	obs.	0	25
	23	..	0	24
	24	..	0	23
	25	obs.	0	21

"The first rate is ¾ second per day fast, the clock having gained thirty seconds in forty days, during which the greatest daily variation was only two seconds.

"The second rate is one second per day slow, the clock having lost forty-four seconds in fourty-four days, during which time the greatest daily variation was only two seconds.

"The clock has only a common wooden rod pendulum. It has four external dials, the indexes of which give both the hours and the minutes, which necessarily comprises a good deal of machinery that is more exposed than the clock itself: and, as the number of wheels and spindles required in such work may not be generally apprehended, I will just observe, that no fewer than twenty-four wheels and pinions, and twenty-three different lengths of spindles, are contained in those works; whence the effect of the variation in the fluidity of the oil cannot but be very considerable.

"*References to the Figures.*

"Fig. 1, a perspective view of the escapement, the escape wheel *a* locked on the rolling pallet *b*. Fig. 2, a front view, having the wheel locked on the other rolling pallet *c*; these pallets roll in frames *d* and *e*, which are jointed at *f* and *g* to the arms *h* and *i*, on the two axes *j* and *k*; these axes carry separate crutch pins *l* and *m*, between which the pendulum rod *n n* hangs; they also have arms *o* and *p*, carrying the adjusting weights *q* and *r*; there is a roller *s* on the pendulum rod, against which the crutch pins act. There the train has nothing to do with the impulse on the pendulum, it is so far detached; but the train partially lifts the frames *d* and *e* during the escape of a tooth, and the impulse weights *q* and *t* alternately, when a tooth drops on the pallet; for when the pendulum has unlocked the middle top of the roller, the tooth pushes it out in passing it; but in this case, the frames *d* and *e* only move on their joints *f* and *g*. In fig. 1, the pendulum is just leaving the crutch *m*, through which it has received impulse from the weight *t*, and the roller *c* has fallen in before a tooth ready to lock it: the pendulum is proceeding through the crutch *l*, to unlock the roller *b*; it is now resisted by the weight *q*, which it has also to lift during the unlocking; but as this is likewise the impulse weight, it must be allowed more motion after the unlocking, or it would give no impulse. This excess is provided and measured by the construction of the roller frames; the frame *d* has a bar *u*, which hangs on the hook *v*, and and supports the wheel when it has dropped on the roller *b*; while in the frame *e*, the projection of the bar *w* is opposite the abutment *x*, which it does not touch by half a tooth. Now, when the escape is made by the tooth dropping from the roller *b*, the train is supported by the roller *c*, this brings up the stood *w* against the abutment *x*, as in fig. 2, the roller *b* rests on the top of the tooth, and the weight *q* hanging on the pendulum gives the impulse, not only as much as the pendulum raised it, but half a tooth of motion farther, or till the roller *b* has returned upwards, and into the bottom of the tooth; therefore, when the tooth drops on the roller *b*, the weight *q* is seen to jump up, because the train hanging on the roller *b* endeavours to bring the joint *f* into a right line between it and the axis *j*, and is only prevented from doing so by the frame bar *x* stopping on the hook *v*. Thus the train lifts the impulse weight and crutch-pin from the pendulum a part of the way at every drop on the pallet; in like manner, the roller *c* has to descend, or return, half a tooth, and to the bottom of the tooth, while the crutch-pin *m* is giving impulse to the pendulum, and on receiving the drop the weight *t* is immediately raised that portion it has to follow to give the impulse. The adjusting weight *q* is the impulse weight on one side, and acts more or less as it is fixed farther or nearer to the axis *j*; but the weight *v* is only an adjusting counterpoise to the arm *i* and frame *e*: *t* is the impulse weight on that side. Fig. 3 is an upper view of part of the axis *h*, showing the adjusting counter-weight *r*, the arm *i*, and roller-frame *c*.

(To be concluded in our next.)

NOTES ON THE CONTROVERSY RESPECTING THE PRINCIPLES OF LOCOMOTION.

Mech. Mag., vol. xv., p. 343. I perfectly agree with Trebor Valentine (and so far with Saxula) that "the axle of the wheel is the fulcrum on which the crank acts to produce" the "rotary motion" of the wheel; but as the mere rotation of the wheel does not *of necessity* cause locomotion, I differ from him, and agree with Saxula, "that the ground is the fulcrum of the lever in locomotion."

Had Trebor Valentine and Saxula viewed the theory of locomotion a little nearer, they would have discovered that there are two cases to be examined separately, which, if considered each as of itself constituting the whole, would naturally lead to the errors into which they have both fallen.

Trebor Valentine would have seen that though we allow the axle of the wheel to be the fulcrum of the crank, this carries us forward but one step in the process; so much of the machine as constitutes the prime mover terminates *there*, which part of the machine will not be stopped in its action merely because locomotion from any cause dependant on the other part of the machine cannot take place; consequently, this does not decide the fulcrum of *locomotion*.

To Saxula I say, that the power of the steam-engine being communicated to the axle, and that power turning the wheel, which is to be considered as composed of an infinite number of straight levers, each of these levers alternately causes locomotion by its momentary action on the ground, on which, (its fulcrum whilst in action), one end of the lever rests, the other end being situated in the centre of the axle in a line perpendicular to the point of resistance on the ground, whether it be a plane, an inclination, or an obstacle. As the carriage moves forward, the imaginary *straight* lever is replaced by another on a point a little advanced in the direction of locomotion, that by another, and so on; these levers, while in action, being always in the same direction. Wherefore, Saxula's *bent* lever and his theory falls to the ground, establishing the correctness of the present theory of locomotion.

To both parties. If we consider locomotion abstractedly, we shall look upon the crank in its rotation as an infinity of straight levers (as I stated of the wheel), each when in action lengthening the line of the supposed levers of which the wheel is composed, thus forming a lever of the first order, longer in proportion to the length of the crank, *crossing* the centre of the axle at right angles with the obstacle, as before stated; and this long lever resting on the ground, and shouldering against the carriage at the distance of the centre of the axle, causes locomotion for an indefinite distance, by means of the power applied to the end above the centre, when another imaginary lever takes the place of the last, and so on. The direction of the power, as regards the effect and of course the action of the lever, is thus always the same; so that if there were an intensity of power communicated to the crank equal to what Saxula obtains by wheels, an ordinary steam-carriage must go up hill, as well even as the Triumph.

P. 407. Here Saxula elegantly and successfully *grounds* the Axleites by demonstrating the correctness of the proposition, that the fulcrum of the lever of locomotion is the ground; and yet, strange to say, he still persists in endeavouring to maintain the necessity of employing what he calls "the longest possible levers," when I assert, that if there were no lever at all, it would make no difference to the locomotive-machine—the wheel; for that part of the wheel of the carriage only which reaches from the ground to the centre of the axle is the lever of locomotion; and if the wheel *is* continued above the centre of the axles, and formed of spokes and a rim, it is only for the convenience of continuing the locomotion, by the recurrence of the imaginary levers; and not because *that* part of the wheel is necessary to locomotion, *for the time that lever which rests on the ground is in action.*

I will go further than what I have said above; because I think it is a pity that any one should be allowed to continue in error, especially when that error may be attended with serious loss to the person who is labouring under it. I say, that if the wheel were fixed to the axle, and the axle could be turned round without a crank or any thing that constitutes leverage; still, if the power be intense enough, it shall cause locomotion with the same effect, *cæteris paribus*, as the same quantity of power applied by means of any number of wheels in Saxula's way; *bien entendu*, that the axle in my case shall revolve with the same speed as it would be made to revolve with Saxula's gearing.

It seems to me, that Saxula wants to establish as a new principle, what I should imagine every candidate for locomotion ought to know and practise, that is to say, to provide for the bad roads, and *slight* elevations, in obtaining a greater power, sometimes at a sacrifice of speed; but I should be very sorry to be at all interested in a speculation in which it was to be accomplished by means of gearing. I should be frightened out of all my senses, even if I did get a quarter of a mile with them; and *my* teeth would chatter, as well as the teeth of the poor wheels, till at last some lucky rut would put an end to our fears, by stopping the coach altogether, when I should find the teeth, instead of waltzing round comfortably together, rolling over one another and knocking one another about, in all the sweet confusion of an Irish *row*.

I advise Saxula, if his steam-coach be intended for common roads, to build an engine to work by expansion, to make his boiler large enough to supply steam in plenty for emergencies, and his engine strong enough to work at the full pressure of the steam that his boiler can produce; and then let him sit down and scheme out some method of getting up hill, otherwise he will no more be able to accomplish it than any other steam-coach projector is at present.

I think it would be no bad speculation for waggons to have a steam-engine; so as to constitute a junction of steam-power and horse-power. I do not see why it should not answer just as well as steam and wind at sea.

P. 409. I cannot resist the opportunity here offered by Saxula himself, of showing him the sand-bank on which he has built his theory; and I should be happy to be honoured with his patience, while I endeavour to contrast his famous No. 5 diagram (p. 197) and its explanation (which contains in it the whole foundation of his new theory of locomotion) with the practical illustration which he here supplies. I have the diagram and explanation now before me, and I will use the same figures of reference, and take his proposition exactly in the case in which he has there stated it, comparing it with others of his own communication; and then he cannot say I have not dealt fairly with him. Therefore, to avoid repetition, begin the phrase (p. 197) of "Let A, fig. 5, represent," &c., and read on as far as the word, "fulcrum C." We will say nothing about the "*bent lever*;" because no such bent lever can, with truth, be imagined in explaining the principles of locomotion. I will now request attention to Saxula's demonstration, p. 409, where he applies the power of his steam-engine to the wheel, by the medium of a pinion, working on an extra shaft, the centre of which pinion is placed in the drawing in a line with the centre of the wheel, at right angles with the road. It will be observed, that here there *is no bent lever;* here there is no dotted line let fall from the rim of the wheel, with a weight dangling at the end of it, to show the direction of the power. Place Saxula's No. 5 diagram by the side of this No. 3, with engines, wheels, and pinions, and all; and then you will see, that if Saxula were to throw a stone, a little stone, before the wheel, which the young gentleman in the drawing No. 2, is so knowingly treading on, locomoting so cleverly, or before the wheel with the *fanged* pinion just as much in advance of the wheel as the little stone appears in the famous No. 5, and then let down a line from the gentleman's toe to this little stone on the road, *carefully dotting out the bent lever*; then, oh! Saxula! art thou not guilty of inconsistency? Is thy *bent* lever now more beyond thy fulcrum than that which thou hast represented in the famous No. 5 to indicate the crank? And yet thou dost pretend *thus* to locomote. Let down another line from the teeth (oh! these teeth!) in gear of the pinion, down to the little stone, *carefully* dot out the bent lever, as before; and then, Saxula, confess thyself fairly convinced, and say thou art wrong.

Yours, &c. Quid.

PRINCIPLES OF LOCOMOTION.

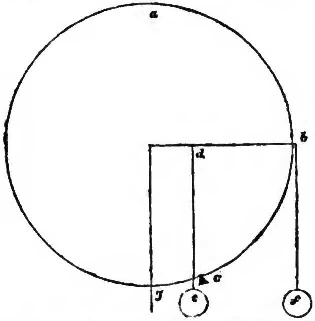
Sir,—Saxula has expressed a wish to have my opinion of his new theory of locomotion; I therefore submit the following for his consideration. At the same time I would observe, that I had not intended to take any part in the discussion upon this question; not having sufficient leisure for the experiments and investigations necessary for the attainment of correct ideas on this most important, and, at the same time, most intricate branch of science; having been called upon, however, I proceed to enter the lists.

If Saxula has calculated upon my supporting his theory, I shall soon undeceive him, and he must be content to stand as at first, "Saxula *against all comers*."

Saxula has submitted twelve propositions, inserted at p. 44, and says, "upon the correctness of these propositions, especially the 5th, the truth of my locomotive theory mainly depends.

Now, Sir, I am of opinion, that the 5th, 8th, and 9th propositions are erroneous, and will hereafter endeavour to prove them so. In the present communication, however, I shall confine my remarks to an exposition of the fallacy of a grand principle, attempted to be established at p. 29, and since so frequently alluded to by Saxula.

The following diagram is there introduced:—



ab is supposed to represent the wheel of a locomotive-carriage; *c*, an obstacle in the road to be surmounted; *d*, a crank; *e*, a weight acting upon the crank in the line *de*.

It is said, that "no force, however great, acting in this direction, can propel the wheel over the obstacle *c*; it may turn it round, twist out the spokes, or grind it into the earth, but over *c* it can never go; because *c* becomes a fulcrum, and the power is on the same side the fulcrum as the weight and acting in the same direction."

Admitting, for the sake of argument, all this to be so far true, we are then told, "but let the power be removed beyond the fulcrum towards *b*, acting in the direction *bf*, and the wheel will at once go forward, whatever be its weight, or whatever be the ascent, under certain limitations, &c."

Naturally expecting that Saxula had ascertained by experiment such actually to be the effect, I was exceedingly puzzled to account for such a result; the more I reasoned upon the case, however, the more strongly was I led to doubt the accuracy of the statement; and, at length, to satisfy my doubts, I had recourse to the experiment myself, when I found, that no such effect as that represented in the above statement takes place; on the contrary, when the power was applied in the direction *bf*, the wheel had no more tendency to surmount the obstacle than before.

In all my experiments I found that a certain weight acting in the direction *de* turned the wheels round, but without producing locomotion; the same weight acting in the line *bf*, also turned the wheels round, but there was no more tendency to locomotion than in the first instance. The only perceptible difference between the two experiments was, that the wheel was turned with more facility in the latter case than in the first; satisfactorily explained by the principles of the levers of different lengths.*

It appeared very evident to me, that the whole having been made to rotate in the first instance, no other effect than *rotation* could possibly have been produced (other circumstances continuing the same) whatever might have been the weight, or however long the lever upon which it acted.

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* It was very justly observed by Trebor Valentine, (p. 343) that the power of an engine being applied to a crank fixed on the axle, is transferred by the spokes to the rim of the wheel, and there acts, of course, in the inverse proportion that the crank-arm bears to the radius of the wheel. Such is the fact, beyond all controversy.

The experiments were repeated several times, with the carriage slightly, moderately, and heavily loaded, and the only difference to be discovered was the amount of friction between the ground and the wheels, and consequently between the weights requisite to produce *rotation;* the *only* effect that could be produced by weights acting on the horizontal spokes of wheels, with obstacles in front of them.

From my experiments I deduce the following fundamental law of locomotion, which I flatter myself no one can disprove; neither do I think Saxula can reconcile it with his theory. If the power of an engine is sufficient to produce rotation of the wheels, the carriage will be propelled, so long as the friction of the wheels upon the ground is greater than the resistance to the advance of the carriage; but, if the resistance to the advance of the carriage is greater than the friction of the wheels upon the ground, rotation, but not locomotion, will be produced, however great the power of the engine, or the length of the crank-arm.

I have before advocated the adoption of longer cranks in locomotive-carriages, and do so still, but on very different grounds to those advocated by Saxula.

Yours, &c. **Wm. Baddeley.**

Sept. 2, 1831.

◆

FIXING CHALK DRAWINGS.

Sir,—I beg to inform "Iota," in reply to his inquiry, at p. 447 of the 14th volume of your instructive miscellany, that he may set his chalk drawings by washing them over with water in which a small piece of common glue has been dissolved. A piece of about an inch superficial, and of the ordinary thickness, will be sufficient for a pint and a half of water. This method I can confidently recommend, as I have been in the habit of using it, and have found it answer remarkably well, though it requires some little care in applying it.

With regard to varnishing, this is a process, I believe, very rarely adopted with chalk drawings. I have never varnished any of my own, and cannot give "Iota" any information upon it: but I should suppose that after a drawing has been set with the above wash, it might be varnished by one of the varnishes used for paintings in water colours.

Yours, &c.

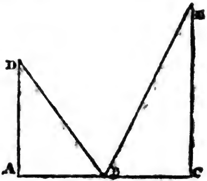
Pit.

Sept. 12, 1831.

◆

OPTICAL PROBLEM.

Sir,—I observe, that at the end of your seventh volume (p. 450) the aid of the *differential calculus* has been called in to solve one of the most simple of problems. Is not this a specimen of mathematics run mad? The problem alluded to is this:—Given the height of two objects AD—CE, and the distance between them AC to find a point B, at which the object would appear of equal height.

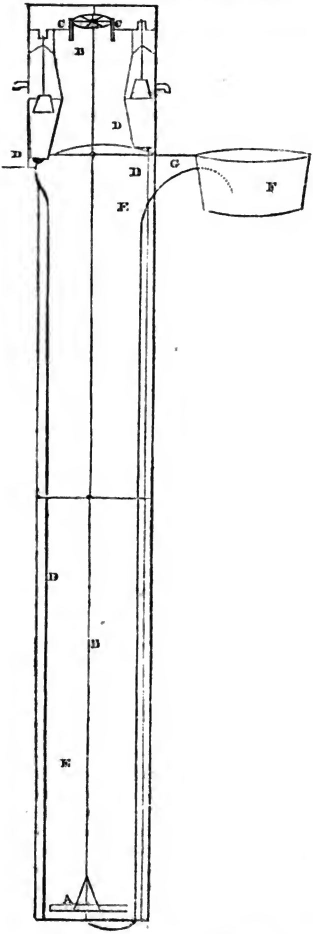


Felix Ford gave an accurate answer (p. 281, vol. vii.); but far from a simple one. Mr. Dowling gave the best and simplest answer (p. 282). The correspondent who had recourse to the *differential calculus*, objects to the other answers given, on the ground that they neglect the height of the spectator's eye above the horizon. The following answer will be found as general:—Let $a = \text{AD}$, $b = \text{CE}$, $c = \text{AC}$, and $x = \text{AB}$, and $c - x = \text{BC}$. From the nature of the problem, the angles at B are equal; hence the two triangles are similar, and we have the proportion $a : b :: x : c - x$, hence $bx = ac - ax = \frac{ac}{a+b}$, which is a general equation for any height whatever; that is, a and b being taken respectively equal to the height above the observer's eye. But the most curious part of the above problem is, that the eye of the observer, in viewing the objects at every point from B to D, moves in the periphery of an ellipsis.

Yours, &c.

A. Mackinnon.

DESIGN OF A CONTINUOUS PUMP.



Sir,—I believe several instances are on record of two persons, unconnected with each other, having invented similar articles or machines at the same time. I am led to this remark, by the plan of "a Journeyman Mechanic," at page 249 of your Magazine; having myself some months since conceived the idea of an arrangement (also with Shalder's Patent Pump) connected with Barker's Mill, by which a continuous stream should be made to ascend from deep wells. You will, no doubt, admit that by affixing Barker's Mill near the water in a deep well, and bringing a long pipe, or the long leg of a syphon, down the side of the well, and connecting it by a well-made moveable joint, under, instead of on, the prime mover or mill, a considerable power may be obtained. The syphon or pipe (for there is no necessity for a syphon) to be supplied by a reservoir at the mouth of the well, which reservoir is to be continually replenished by the pump or pumps on the top of the well, and worked either by a rod or a band connected with the prime mover. Inclosed is a sketch of my plan, which, if you think worth insertion with my letter (that others may improve thereon) it is at your service; but I fear the work to be done will prove too much for the machine. What says Mr. Baddeley?

Yours, &c.

S. Deacon.

Skinner-street, July 1, 1831.

Description of the Engraving.

A, Barker's Mill. BB, connecting-rod between the power A and the wheels CC. DD, the pumps. EE, the well. F, the reservoir. G, from reservoir to supply the mill A.

P. S.—The length of the arms of the moving power may be easily extended by excavating a groove in the well, protected by inserting cast-iron sections of the groove at a sufficient height, that the water may not interfere with the arrangement.

S. D.

* * *

STEAM-ENGINE GOVERNORS.

Sir,—I beg leave to call the attention of some of your readers to an error concerning steam-engine governors, which seems to prevail among a number of people who might be expected to know better. Their idea is, that the speed of an engine will be regular, whether the work done by it be increased or diminished; which is far from being the case.

Dr. Lardner, in his "Lectures on the Steam-Engine," p. 95, says concerning the governor:—"The peculiar beauty of this apparatus is, that in whatever position the balls settle themselves, the velocity with which the governor revolves must be the same; and in this, in fact, consists its whole efficacy as a regulator. Let us suppose that the engine is working 100 looms, and that 50 of them are thrown out of gear. The engine is thus suddenly relieved of half its load; and the supply of steam before employed will now make it revolve at a considerably increased velocity. The balls will immediately fly from the axis and partially close the throttle-valve, and diminish the supply of steam. When this is so far accomplished as to restore the engine to its former velocity, the balls will become stationary, and continue to revolve at the increased distance from the axis with the same velocity as they before revolved at the original distance." Now, this contains a contradiction, which must be evident to every reader; for if "in whatever position the balls settle themselves, the velocity with which the governor revolves must be the same," be true, which it certainly is, how is it possible that the "balls" will continue to revolve at the increased distance from the axis with the same velocity as they before revolved at the original distance" This I find is also stated in "The Library of Useful Knowledge."

Now, every engineer who has had charge of an engine knows, that when there is more or less work to be done, the throttle-valve requires to be set accordingly, which is easily done, as there is generally a set-screw for the purpose. The governor merely regulates the speed when the resistance is increased or diminished suddenly, and for a very short time; but if it continues for any length of time, the speed will be altered accordingly.

As it would be a great improvement in steam-engines to be able to regulate themselves completely, some of your ingenious correspondents may perhaps furnish us with a method. I think it might be done by having two governors—one to work the valve as usual, and the other to alter the connection between governor and valve. Hoping this hint may be improved on,

I remain, Sir, yours, &c. **Jasper.**

Sept. 1, 1831.

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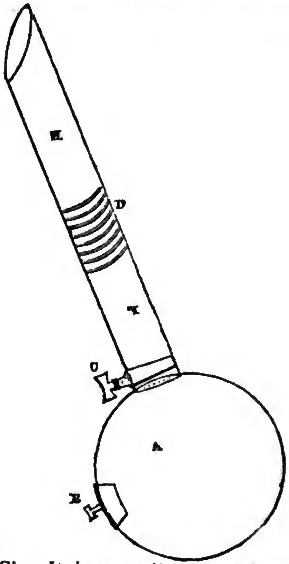
MR. DEWHURST'S IMPROVED CUPPING-TORCH.



Sir,—It is generally admitted, that great inconvenience attends the application of the common spirit cupping-lamp, and the common torch. Nor is that removed, but on the contrary, increased, by the one which I am informed is recommended by Mr. Knox. In the hands of the pupil, and even of the most experienced cuppers, these instruments are likely to cause much annoyance by the spirit passing too freely through the cotton, and in its ignited state increasing the suffering of the patient. If to avoid this, the cotton is compressed, then the spirit will not flow sufficiently free, thus creating an inconvenience to the operator. It is true, that in the hands of an expert cupper, all this may be avoided. However, it appears to me necessary that an instrument should be adopted, over which every operator can have such controul, that the cotton shall be sufficiently saturated, and every risk of the inconveniences I have before mentioned be removed. Prefixed is a sketch of an instrument, I have devised with this view, and which is exceedingly simple in its construction. The controuling power consists in the plug C, which being pulled up, gives exit to a sufficient portion of spirit; this being done, and the plug returned, all further communication is thereby arrested. Other improvements will be found elucidated by an inspection of the engraving.

As an improvement of the cupping-case, I may mention, that I consider Mr. Weiss's improved scarificator far superior to any other now in use. I have used it invariably for the last nine or ten years.

Should you consider this communication sufficiently interesting to the mechanical world, and particularly those connected with my own profession, I shall feel gratified by its early insertion.

Yours, &c. H. W. Dewhurst,
Professor of Human and Comparative Anatomy.

September 1, 1831.

Description of the Engraving.

A, the bulb to contain the spirit. B, the stopper at the upper part to admit the spirit. C, the plug to regulate the quantity of spirit admitted into the tube, to saturate the cotton in the portion of the tube marked E. D, the connecting screw belonging to the tube E, which is admitted into the portion of the tube marked F. E, the portion of the tube into which the cotton is to be inserted. F, the connecting-tube between the bulb and the part E.

HINTS FOR IMPROVING STREET PAVING.

Sir—One of your correspondents, J. B. page 114, has made some remarks on my hints for improving street paving, inserted in No. 414, which I must beg leave to answer. J. B. admits, that more horses fall now than formerly through the smoothness of the street-paving, but raises two, as I consider, groundless objections to my suggested remedy.

In the first place, J. B. considers the proposed alteration unnecessary, inasmuch as in a few weeks after the stones are laid down, the fissures between them widen, and furnish the abutment, which my plan is calculated to afford, for horses passing over them. No such effects, however, take place, nor can they; the surface of the paving being the segment of a large circle, the flattening which continual wear produces, must inevitably have the effect of bringing the stones as closely as possible together.

The second objection is, that my proposed improvement would increase the difficulty and danger in frosty weather. If J. B.'s first objection were *true*, this must, of necessity, be *false*—they are, however, both equally erroneous. To those who witnessed the newly-paved streets* during the last winter, it will be unnecessary to offer a single remark; to J. B., however, I would observe, that if my plan made them no better, no alteration could make them worse in frosty weather than they are at present. They now present one solid surface of ice, after the first fall of snow succeeded by severe weather; and so continue until the frost breaks up, covered more or less by the powdered ice produced by the traffic upon them.

Yours, &c. W. Baddeley.

September 1, 1831.

EXPLOSIONS IN COAL MINES—MR. RYAN'S SYSTEM OF VENTILATION.

Sir,—Not only is humanity perpetually shocked by details of the loss of lives by *explosions in coal mines*—but these, by deterring adequate capitalists from embarking in such collieries, greatly enhance the price of this useful article, so indispensable to our power and prosperity.

From time immemorial the *ventilation of coal mines* has been conducted on a system which assumes the necessity of having a quantity of atmospheric air to mix with the hydrogen gas, and carry it out of the mine. This is explained in a "Report to a Society (in Sunderland) for preventing Accidents in Coal Mines," by Mr. John Buddle, thus:—"The only means we are at present acquainted with for preventing accidents by fire, is a mechanical application of atmospheric air to the removing or sweeping away the inflammable gas as generated in the workings of collieries, or as it issues from the several fissures which the workings intersect in their progress."

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* Cheapside, for instance, where, last Christmas-eve, I saw a coal-waggon nearly opposite Bow-church, which was forced to be left there all night, the horses being unable to stand upon their legs, from the slippery state of the road.

The total inadequacy of this system for the purposes contemplated is rendered obvious by the numerous burnings, averaging *ten thousand* annually, and by the sacrifice of from *five hundred* to *one thousand* human lives, by the explosions which are yearly announced; to say nothing of the explosions wherein life has not been endangered, and of which, on that account, no public notice is taken. Many deaths, besides, occur in the ordinary workings of mines, rendered precarious by such explosions. The necessity of substituting a more effectual mode of ventilation is therefore abundantly apparent.

The examination of a plan of a northern colliery, whose site is one mile, will elucidate the intricate method by which this simple fossil is quarried, and the small portions into which it is cut, in accordance with the existing mode of ventilation. The field presents *one hundred and forty-seven* roads, each a mile in length, and twelve feet wide, driven on the face of the coal; and two feet of this width is reduced to slack by the workings. Another and more extraordinary waste of coal is caused by cutting at the end of the coal 88 drifts, each a mile long, and 6 feet wide, of which 2 feet is reduced to slack to be burned on the bank; for the collier, in a 6-feet coal always holes 2 yards and under, and cuts 4 yards. Here, therefore, are 235 miles of passage, and all the consequent waste of coal and labour. To this waste must be added the expense of 12,000 dams, some miles of board-brattising, doors, trappers (boys to shut the doors), and additional horse-labour; as also the quantity left in pillars, (double what is extracted), to sink in the floor of the mine, but which could only be got out (says Mr. Buddle) by means of the Davy lamp. Now, were this mass of coal at the surface, would such a method of quarrying be for one day permitted? Certainly not. And, in reference to the supporting of the roof, there can be only one opinion among intelligent men, namely, that the strata are stronger at the time when first exposed to the atmosphere than they will be at any subsequent period; allowing the coal to be then extracted, at less expense of property and of life.

The coal is quarried according to the peculiar cleavage called the *face*—the crystallization which divides it into parallelograms of about 30 inches diameter; out of the fissures between which issues the deleterious gas in varying quantities. According to Phillips and Conybeare, some of these blowers give forth 100 barrels per minute; but say 600 feet of gas from one back, and there will be 2000 backs in the mile area. Mr. Buddle states, that in a colliery of which he has the charge, and where he adopts his favourite method of air-courses, to keep it free from explosion, 18,000 feet of atmospheric air are required each minute; and that the lowest point of explosive mixture is 14 of air to 1 of gas. Now, supposing all the backs to discharge 1000 feet of gas, and allowing to this 15,000 feet of air, careful admixture would prevent explosion, because it would be 1 above the firing point, and there would be 3000 feet of air left for any emergency. For example—suppose that at 6 o'clock in the morning the atmospheric pressure on the barometer were equal to 31 inches of mercury; this would counterbalance the gas in the backs, and prevent its escape until the force were equal to that pressure by the constant generation of gas in the backs. Again, suppose that at 9 o'clock the pressure were equal to only 27 inches, not only will the four portions of gas escape into the mine instantaneously, but a greater influx of gas will result from the diminished pressure on the backs, and form an explosive mixture; because, although there were left 3000 feet of air after diluting the gas discharged at 31 inches' pressure, this quantity would mix only half a quarter of a foot of gas; and at 27, there would be less air, yet greater need of it to prevent explosion. Here, therefore, may be found the true cause of the disasters; which, although of frequent occurrence in the northern mines, are yet awful when they do occur; and to guard against them requires, on this system, great labour and immense expense. Since the employment of the Davy lamp, the explosions have changed their character; but that is all. In 1806, an explosion affected only a few of the men, because they worked only where they could take an open candle, but now it destroys all in the mine—nor leaves one hapless victim to tell the tale of woe. In whatever way it is viewed, the system is obviously *weak and inefficient, and most so at the moment when it requires to be strongest and most effective.*

This system was adopted in the Staffordshire coal-field, and in the 6-feet and 8-feet coals few explosions occurred, and with little loss of life—from the cause just noticed. But when applied to the explosive portion of the 30-feet, or main coal, even under the direction of the best viewers in the kingdom, it proved inadequate to prevent explosion even for a single day. The state of the mines in 1808 was such, as to render proceeding under this system impossible; and an artificial mode of explosion was had recourse to, known by the name of the *fire-line.* Still many mines were not worked at all, because they could not be kept free, for any considerable time together, from the deleterious gas.

It remains to detail a system directly the opposite of the one already noticed, and to prove its complete efficiency by a reference to the Staffordshire mines, where it has been in operation since 1809.

This system proceeds on the fact, that, however many dislocations there may be parallel with the backs, only when there is a dislocation or fault *across* the direction of the backs, does carburetted hydrogen accumulate and become destructive. What is, then, to be done to prevent this accumulation? Along the whole extent of the dislocation, or fault, cut off the ends of the backs by a drift, into which all their blowers may discharge the gas they generate. Close up this drift from the men, and form a vacuum therein by either fire or pumping; the hydrogen, owing to its extreme levity, will flow upwards into this rarefied medium; and the atmospheric pressure along the working courses of the mine, will keep the hydrogen in the fissures, or prevent its intermixture with the air which the men and horses respire. The higher the rarefaction of this drift, the less will be the quantity of hydrogen accumulated at any certain time; but whatever be this state, as the men cannot bring their candles into this drift, no explosion can possibly occur, for the current of air in the mine will also cause the azotic gas, generated by respiration, to flow along the same fissures with the hydrogen into the drift, and so preserve a proper fitness in the atmospheric air for the use of the men and the horses. Whatever be the quantity of gas discharged by any, or by every one, of the blowers, it is obvious that the whole will ascend into the rarefied drift, with a velocity accelerated in the ratio of the elevation and rarefaction; for, as it descends downwards by its generative force, even when opposed by atmospheric pressure, its levity will carry it upwards when a rare medium is presented, although there were no such pressure. The only cure absolutely requisite is, to cut the drift along the whole extent of each dangerous dislocation, on the side where it prevents the escape of the hydrogen to the surface.

The fullest investigation possible of the real merits or defects of these two systems, instead of being disregarded, or longer delayed, should be most peremptorily commenced, and perseveringly pursued by the philanthropists of the age, that all the advantages possible to be derived may not be longer withheld from that valuable and useful class of his Majesty's subjects—the colliers.

I may again trouble you with my remarks.

Yours, &c. JAMES RYAN.

Middletown Hill Mines,
Montgomeryshire.

[We have received another able letter on this subject, signed "Humanitas," to which we shall give an early place. Mr. Ryan and his system deserve more public consideration than they have hitherto received.—ED. M. M.]

◆

ENTERTAINING LIBRARY. THE MENAGERIES.[*]

In our last review of the Library of Entertaining Knowledge, we animadverted on the partiality of its conductors for minute subjects:—the volume we have now before us seems intended to show with what facility they can run into the opposite extreme, the sole subject of it being the ELEPHANT. The first volume of the series of "Menageries," disposed of the lion, the tiger, the camel, the wolf, the dog, and an immense number of other quadrupeds;

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[*] The Library of Entertaining Knowledge—The Menageries—Quadrupeds, described and drawn from Living Subjects. Vol. 2. London: Charles Knight, 1831. Small 8vo., pp. 396.

while the second is wholly occupied by *one*. To do this, too—to make the elephant, largest of the beasts as he is, fill up so vastly disproportionate a space, some book-making ingenuity has been found necessary, and we are not only presented with more than the usual quantity of information on the usual points, but with whole chapters on subjects which it requires a stretch of the imagination to connect with that of the main body of the work. It is rather discursive to devote no inconsiderable quantity of pages to the consideration and delineation of ancient medals, containing the figures of elephants; but it is almost transgressing the widest bounds, to give a long history and description of the celebrated statue of Jupiter by Phidias, merely because one of the materials employed in its construction happened to be ivory! Yet this way of writing, when not carried too far, is very "entertaining," and, therefore, perhaps, not much out of place in this series of the Useful Knowledge Society's publications; it is, however, not of very novel invention, for it has long ago been tried by Bishop Berkeley in his celebrated "Essay on Tar Water!"

The first half of the volume—that which is occupied solely by legitimate matter—is, after all, the best. The latter portion of the volume bears too much the air of having been laboriously elaborated in order to fill up a respectable space; and its facts refer to times too remote to excite much interest. We extract, as a favourable specimen of the first part, a few remarks on the trade in ivory:—

"There is a peculiarity in the commerce of elephant's teeth, which forcibly arrests the imagination. Ivory is not an article of paramount necessity. The fine marbles would answer the purposes of statuary better, even if the ancient art of sculpture in ivory were restored; and the harder woods are quite as useful in the manufacture of furniture. It is required only for ornaments which are by no means suited to every taste; for modern Europeans have not a passion for ivory, as the Romans are said, by M. de Caylus, to have had, and yet the demand in this country, of which we see and hear little, gives activity to whole tribes of Africans—makes elephant-hunting a trade—exposes man, as we shall presently show, to the most appalling dangers, and the severest privations—and spreads terror amongst thousands of these unoffending animals, who appear to have a natural right, which they have enjoyed from the creation, to the immense savannas upon which they pasture. Mr. Pringle, whose description of a herd of elephants we have already given, speaking of the inclinations of his companions to attack this herd, which desire was suppressed by a feeling of the danger, says, "When I looked around on these noble and stately animals, feeding in quiet security in the depth of this secluded and picturesque valley, too peaceful to injure, too powerful to dread any living creature, I felt that it would be almost a sort of sacrilege to attempt their destruction in sheer wantonness, merely to furnish sport to the great destroyer, Man; and I was glad when it was unanimously agreed to leave them unmolested."—P. 126.

The following particulars as to the quantity of ivory used in Europe are curious:—

"It would be exceedingly difficult to estimate, with any pretension to accuracy, the present consumption of ivory in Europe. Its use must have been considerably diminished on the one hand, by the changes of taste, which have dispensed with the ivory beds, and ivory chairs, that adorned the palaces of princes in the age of Leo X. and have displaced the inlaid tables and cabinets of a century later, by articles of furniture distinguished rather for the excellence of their workmanship than for the cost of their material. But, on the other hand, the increase of comforts and luxuries amongst the middle classes of society, and the love of tasteful ornament which has descended from the palace to the cottage (one satisfactory symptom of intellectual advancement) has probably increased the consumption of ivory in small articles. We understand, that at Dieppe there are at present 11 flourishing manufactories of articles in ivory, from which various specimens of art, from the commonest piece of turnery to the most elaborate carving, are dispersed throughout the Continent. Much is employed for crucifixes, and other appendages of Roman Catholic worship. In our own country the demand for elephants' teeth, to be employed in the manufacture of musical instruments, plates for miniatures, boxes, chessmen, billiard-balls, mathematical-rules, and small pieces for carving, is much more considerable than might occur to superficial observation. In 1827, the Customs upon elephants' teeth, the duty being 20*s*. per cwt. amounted to £3,257, exhibiting an importation of 364,784lbs. In 11 years, from

1788 to 1798, 18,914 cwt. of ivory was imported, which shows an average annual importation of 192,579lbs. The average weight of a tusk is about 60lbs. To have produced, therefore, 364,784lbs.—the import of 1827—6080 tusks must have been procured. This fact assumes the annual slaughter of 3040 elephants. But the real havoc is much greater."—P. 124.

This is more germane to the matter than long dissertations on ancient statues, or even on the fossil remains which are every now and then dug up in various parts of the world, and serve only to excite the astonishment of the learned, and to form the foundation of ricketty theories of the antediluvian ages.

The getting-up of this volume is altogether very creditable. Many of the cuts are gems in their way: we may particularize that of the Female Elephant suckling her "Calf," which is excellent—another of an Elephant Lying Down on his Belly, is scarcely inferior. Young Elephants Browsing, and the Elephant of the Jardin des Plantes, are also very neatly executed: but most of the large engravings—Elephant Hunting—March of an Indian Army—Elephant harnessed in a Keddah, &c.—are rather clumsily done. The latter part, too, is absolutely overlaid with representations of antique medals, some of which are almost entire repetitions of each other. On the whole, however, this volume of "The Library of Entertaining Knowledge" will not lower the high character of the work.

◆

COMMERCIAL SCIENCE.

The Imperial Standard.

Sir,—Mr. Woollgar preceded Mr. Mathieu in calculating, that – 1 English foot =3·0479449 deci-metre.

$\sqrt{\ }^{3} = 28{\cdot}3153$
2
———
2 *foot* = 56·6306 litres of water, weighing
56·6306 kilogrammes of 200 francs =
francs 11,326·12

or Spanish $\left\{\begin{array}{l}\text{100 pints English}\\ \text{100 pounds English}\end{array}\right\}$ $\frac{1}{5}$ – 2,265,224
———
= 2,060·896 = 2 English foot cubic of Alcohol, in the ratio to water, by the French *Standard* Thermometer centigrade.

Mr. Mathieu calculates 100 pounds English = 45·34148 × 200 = francs 9,068·296.
The *loss* to England is, - - - - - - - 7· 4
———

Per 100 pounds avoir-du-*poids*, in the Exchanges with France, Holland, and Belgium. This mis-calculation is caused by the "Imperial" gallon, which, with more propriety, might be denominated the *monopoly* gallon. The gallon cannot be considered a *wholesale* measure, while liquids are sold by the "Imperial" gallon, at retail prices. The majority of house-keepers are without room for a larger liquid measure than two feet cubed of wine, PORTER, ale, or spirits.

Mr. Utting will find that the Oriental measures, and the English foot are *one* measure. Two Oriental cubits = 3 English feet.

1 East Indian and Russian gus - = $2\frac{1}{3}$
3
—
1 Russian fathom!!! = - - - - 7
7 × 500 = 3,500 English feet = - 1 Russian verst.
10 × 1,000 = 10,000 - - - = - 1 East India cos,

or cosmographical line, or let it be *The Imperial* LEAGUE, to demonstrate that between it and the "Imperial" gallon, there is the measure of the Imperial sarcasm—from the sublime to the ridiculous!

Yours, &c. T.

September 10.

The public are, notwithstanding this error, much indebted to the Commissioners of

Weights and Measures, for having established one great principle of national accountability—one measure of capacity.

1 imperial pint = 34·65925 inches.
1 "deci-mil" pint = 34·56 to
the *retail* purchaser; here is the celebrated distinction without a difference.

◆

ZINC MILK PAILS.

Sir,—Lately observing, in your Magazine for April, 1831, among the "Notices of Recent American Patents," one for a process for extracting cream from milk *by the use of zinc* (p. 109) I have been led to trouble you with the following remarks thereon.

It is said, "Put zinc into the milk-pan, or put milk into a vessel made of zinc, and the same quantity of milk will yield a greater quantity of cream or butter." And a little further on, "*We believe this application of zinc to be really new.*"

Whether zinc possesses the "useful" property ascribed to it, or not, is a question distinct from my present object, which is to convince you, that *the application* is NOT really new.

I have in my possession a piece of rolled zinc, which is all that remains of a milk-can, that measured 2 feet across, and about 8 inches deep. The vessel was purchased, as old metal, by a tinman and brazier in this town, about 18 years ago. It had been found at some depth in the ground, and bore evident marks of having lain in that situation for many years. The other character which it also bears, that of being *rolled* zinc, cannot fail to strike your readers. Should you consider it a curious and valuable piece of antiquity; or serviceable only to establish the fact for which I have mentioned it, and as, therefore, worth your acceptance; it is quite at your service, if you will direct me how to send it.*

Now, whether our ancestors were induced to use their milk-cans made of zinc, from a reasonable preference, and being well aware of any such valuable property belonging to zinc, I am not prepared to determine; but, I am convinced many of their practices go to prove, that they had more of *reason* on their side than some persons believe.

Yours, &c.
B. DILLON.

Wrexham, Sept. 7, 1831.

◆

Bertin's Acentric-Wheel, Mech. Mag. No. 409, *p.* 226.—Sir, I should be much obliged to Mr. Bertin, or to any of your able contributors, for instruction on the subject of the acentric-wheel; its alleged advantages, in point of diminished friction, not being clear to me. The "moving pinion" B acts on the acentric-wheel C, which acts on the pinion D, and so forth; but where is the advantage of this arrangement? Why not have two wheels, B and D, of suitable diameters, and of the same relative proportion, viz. as $3\frac{1}{4}$ is to $4\frac{5}{16}$, or $\frac{69}{52}$, the first to act on the second without the intervention of the acentric-wheel? The weight of the acentric-wheel presses on the pinion D, or on some roller, from which it is suspended; there must also be rollers to prevent lateral deviation; will not there be greater friction than if an axis were employed? How is an acentric-wheel usefully applicable to a capstan? It would not be satisfactory to me to be referred for an answer merely to the experiments, for there may have been negligence or error connected with them; besides, they do not explain what to me appears obscure.—Yours, &c. W. N, *City, Sept.* 12, 1831.

◆

How to make Oil unite with Water.—It is said, that dried gum, soaked in oil, makes the latter unite readily with water. This takes place even by pouring all into a mortar, adding water, then throwing in gum arabic, in powder, and shaking or stirring the mixture well.—*Bull. des Sciences Technologiques.*

Persian Mode of Manufacturing Borax.—The water of an alkaline spring, above an inch in diameter, is collected in marble basins, and thence conveyed into untinned copper kettles, where it is mixed with blood, urine, and leather scrapings, and allowed to putrify for five or six weeks. The deposit at the bottom of the kettle is then boiled with water; and on cooling, a rude but not crystallized species of borax, called by the Persians *bora*, is obtained.

◆

INTERIM NOTICES.

We cannot make out from H. P. L.'s manuscript the name of the third ingredient in his recipe.

We shall send Mr. Franks an appointment in the course of next week.

Communications received from Mr. Hayter—An Emigrant—An Amateur—Σ—F. H.—D. D.—Emilius.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office-court, (between 145 and 146) Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

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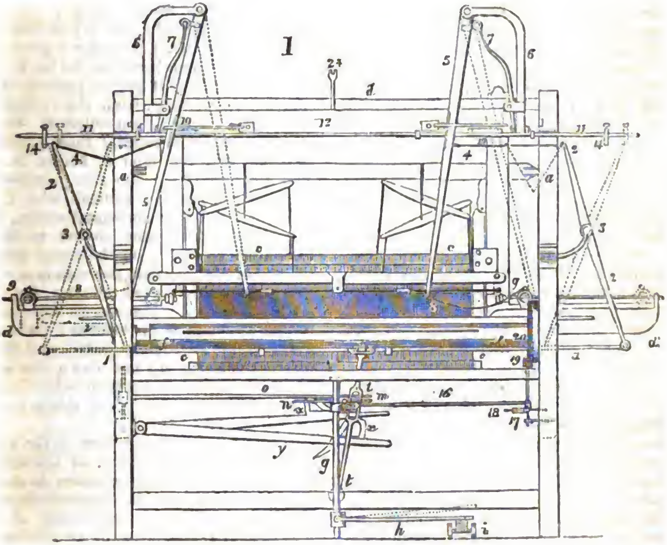
* We thank our Correspondent for his offer, and shall be glad to receive the relic through the medium of our publisher.—ED. M. M.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 424.] SATURDAY, SEPTEMBER 24, 1831. [Price 3*d*.

WHITE'S IMPROVED POWER-LOOM.



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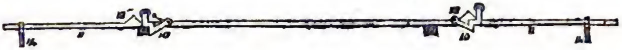
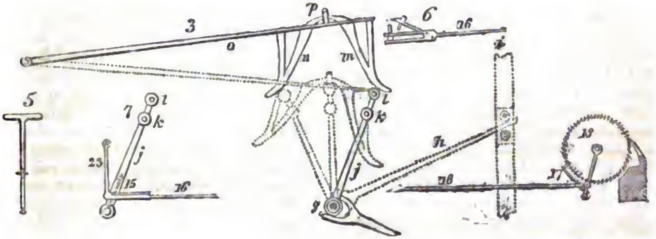




WHITE'S IMPROVED POWER-LOOM.

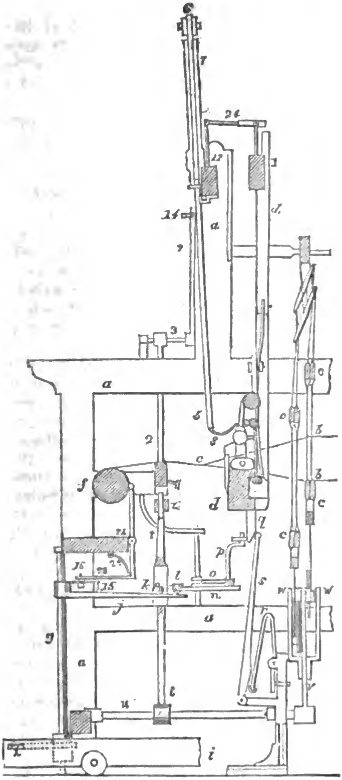
The great obstacle to the weaving of fine yarn by power is the breakage produced by the common application. The shuttle is thrown by a force that is not capable of exact regulation, and depends directly on the speed at which the loom is worked. It is thus variable. When it falls a little low, the shuttle can scarcely be thrown across the web; and when the speed is high, it is driven with an excessive force. To stand this harsh and severe working, the shuttle must be a strong and heavy block; and were it applied to fine weaving, it would chop the yarn in the shell. This single circumstance alone renders the common power-loom inapplicable to fine yarn.

Mr. George White, of Hutchinson Town, Glasgow, has at length contrived a power-loom in which this objection to its application to fine fabrics is obviated in a very original and ingenious manner. The shuttle acts by a force that is invariable, and independent of the speed. No more power is required to be given than merely to throw the shuttle easily from side to side. The shuttle can thus be made light, and adapted to any sort of work, however delicate.

Fig 1 of the accompanying engravings, is a front, and fig. 2 a side view of Mr. White's loom; *a a a* is the frame; *b b*, fig 2, the warp-threads; *c c* the headles through which they pass: these alternately raise and depress the alternate threads, and form what is called the shed for the shuttle to pass through; *d d* the lay through which the threads pass; *e* the junction of the shed with the cloth just weaved, called the felt; *f* the beam on which the cloth is wound. The movements of the loom are four—the shed, the shuttle, the lay, and the beam. They all derive their motion through a vertical axis *g*; it receives an alternate motion by its lower arm *h*, which falls in a gap, or between two rollers, on a long bar *i i*, moved to and fro by the original power. This bar, forming the connection between the first mover and the loom, must be long enough to extend to all the looms which local convenience will allow to be arranged in one right line, and therefore must have as many gaps in it as there are looms. *j* the upper arm, carrying two friction-rollers *k l*, shown separate in plan, fig. 3; the roller *l* traverses the rail *m* when moving on the right side of the axis *g*, and the rail *n* when moving on the left, and on either side pushes away the bar *o*, on which is a standard *p*, shown best in fig. 2, where it engages the lay by passing through a hole elongated right and left in the piece of metal *q*, which is fixed to the sole of the lay. Here the arm *o*, which is fixed in the frame *a*, bears all the lateral strain of the power, while the lay can receive from it only a direct motion from the felt; the lay is urged forward again, when the roller *l* goes to the centre, by a spring *r*, at the back of the lever *s*, which it presses against the edge of the piece *q*: both the spring *r* and lever *s* have friction-rollers at their ends. While the roller *l* thus pushes back the lay, the roller *k*, acting in a loop through which the arm *j* passes, gives motion to the vertical arm *t t*, which is fixed on a horizontal axis *u*, to communicate the same motion to the back upright arm *v* on the same axis, the top of which carries two rollers *w w*; they traverse the curved rails *x x*, fig. 1, on the arms *g y*. These arms are connected by chains to the headles *c c*, which are thereby alternately raised and depressed, carrying up and down the alternate threads *b b*, between which the shuttle is to be thrown; and this is now to be described.

We must, therefore, return to the upright arm *t*, through which, as has been already stated, the arm *j* passes, to give it motion; the top of this enters between rollers in a loop *z*, in the middle of a long bar 1 1, and gives it an end motion; at each end of this is jointed a two-armed lever 2 2, 2 2, which turns on its axis 3 3; the upper arms are connected with two wire-links 4 4 to the shuttle-shafts 5 5; these are jointed at top in the standards 6 6, and are urged towards the centre of the loom by strong springs 7 7; the bottom of the shafts are connected by strings 8 8 to the drivers 9 9, and these latter, when the shafts 5 5 are drawn outwards, are retained by catches 10 10, shown separate in plan, fig. 4. Now, in order to let fly one shaft to throw the shuttle, while the other is retained, there is a long slender rod 11 11 hung under the rocking-tree 12, so as to slide endways; this is shown separate in fig. 4; it has two angular projections 13 13 near the catches 10, and the catches have friction-rollers; the motion

Fig. 2.



of the rod is to carry these projections from one side of the catch-rollers to the other, in which case both the catches are removed, and the one shaft that was retained is liberated; the rod is also furnished with elbow-pieces 14 14, which are fixed to the right places, near the ends, by binding-screws. Now, when the arm 2 on the left is thrown out, as in fig. 1, it pulls back its shaft 5 behind the catch 10, by means of the links 4, while the opposite or right arm 2, moving inwards, drops its links 4, the shaft and links being then in a position shown by the dotted lines. At the same time, the left arm 2 striking against the elbow 14, has carried the rod 11 so far to the left as to withdraw the two catches 10 10, its own shaft being then retained by its links 4 only; and the right shaft 5 being released, has sent the shuttle across to the left side. The left shaft 5 is next pulled back, and the projections 13 13 pass their respective catches, so that, on relaxing the pull, the catch is again ready to retain that shaft, and the projection is on the proper side to liberate it when the opposite movement is made: thus, when the arm *t* goes to the right, the shuttle is thrown from the right, and when it goes to the left, the shuttle is thrown from the right, and when it goes to the left, the shuttle is thrown from the left, and between each the spring *v* sends the lay to the felt.

The winding-up is performed from the arm *j*, on which a small rod 15, figs. 2 and 7, is mounted; this moves the connecting rod 16, figs. 1 and 3, which, by a catch 17, moves the ratchet-wheel 18, one or more teeth at a time, while, by means of its pinion 19, a still slower motion is given to the wheel 20, on the beam end. Now, as the diameter of the cylinder, formed by the beam and the cloth upon it, is continually increasing from the beginning to the end of weaving each piece, it is evident that the rate of the revolution of the beam must be retarded in proportion to the increasing diameter of the cloth wound upon it, in order to preserve a uniformity of strain or pull on the threads of the warp. This is effected by the following self-adjustment;—A lever, shown separate in fig. 5, is jointed in the middle at 21, fig. 2, to the slab under the beam: its T head is pressed against the work on the beam by a spring 22 acting against the bottom. The bottom of this lever is connected by a small rod 23 to the end of the longer rod 16; therefore, as the diameter of the beam increases, it pushes the T head farther from the centre, and its tail pushes in the connecting-rod 16 nearer to the axis *g*: this lessens its motion exactly in proportion to the increase of the cloth on the beam, and makes it wind up equal quantities from beginning to end.

Figs. 6 and 7 are parts of this movement. Fig. 6 shows the forked or loop end of the rod 16 with a hook raised up: in this case the rod 15, which passes through it, can move right and left without moving the rod 16; in this position it will not wind up the work, but, if the hook is dropped, it confines the wire 15 to the end which then moves it. Now it is requisite to enable the lay to raise this hook in case the shuttle be empty or its thread break, which is effected in the following manner:—As the felt would then be drawn from the lay, it would advance nearer to the front of the loom: a lever may be so placed that the lay shall then strike it, and make the other end pull a string which connects it to the hook; this will raise it, and the loom will go on without winding up. To stop the loom, a string is placed handy to lift the arm *h* out of its gap in the moving bar *i*.

The rocking tree is connected to the top of the lay by a short adjustable arm 24; but as its joints are at different distances from the centres of the lay and rocking tree, the shuttle shafts do not move so much as the lay, but are kept sufficiently near; this inequality, and the slightness of the connexion, prevents the lay from receiving any shake or violence from the strong actions on the rocking tree. The spring *r*, which moves the lay, and the springs 77, which urge the shuttle shafts, have screws at their tails, by which they can be adjusted exactly to the required strength, so that their action shall equal that of the best hand; the arm *o* bears all the lateral action of the power when sending the lay back; the lay receives no bias from it, and the arms *y y* bear the lateral action when raising and lowering the headles: thus the working parts, or those which come most in contact with the threads, are so far detached from the power which causes them to move, that they act softly and smoothly.

The shuttle for this loom may be of the same size as those used by fine hand loom weavers. It must not, however, be larger, and the wheels of the shuttle must stand very little above the box—just enough to float it into the box of the lay. This is to prevent the shuttle from cutting the yarn in the shell, by causing it to work on the thread partly as a slide. The shell should be no bigger than merely to receive the shuttle, that the yarn be not weakened by a great gap; and for the headle-eye one quarter or two-tenths of an inch is sufficient. The traverse of the lay may be four and a half inches. Power is given to it to cause it, to work at the required speed by the spring. It acts exactly as the hand-loom lay, and is subject to the same regulations. In applying it to cambrics, jaconets, or lawns, it should be wrought by an upper shell, a single flighter, or a card, according to the kind of fabric.

There is another consideration of great importance in the weaving of fine yarn, namely, the proper state in which the web must be kept when working. The yarn hardens after it is dressed, and becomes brittle; besides, the cloth is not fair nor even when a fine web is in this state. It must be kept, when working, slightly damp, as when newly dressed.

This Mr. White effects by means of the following apparatus, by which the web is kept in a better state than if it were dressed stretch after stretch. A tube, in length the breadth of the web, is placed horizontally on its pivots behind the rods about half an inch under the yarn. The tube is perforated with small holes, and covered with a thick flannel cloth sewed tight to it. The flannel, indeed, may be double; and it is to be well carded on the outside, to raise the nap. The tube is filled with water, and, being driven by a cord from the gearing in the factory at a considerable velocity, the water will exude through the flannel and be thrown on the yarn like dew. The velocity will regulate the quantity of moisture to be thrown on the web, which is to be no more than will keep the yarn in a moderately damp state.

In the communication of power by means of a band, there is much vibration, besides tear and wear of the material, and loss of power in working the gearing; and as the movements of this loom are oscillatory, not rotary, a different sort of gearing is made use of, for the suggestion of which Mr. White owns that he is indebted to an ingenious friend, Mr. Robert Short. The movements are produced directly by rods driven by the shaft in the recess in the factory. The rods are supported from the floor by friction pulleys, and the handle *b* of the loom, fixed on the lower end of the centre, works in a notch of the rod between two pulleys. Four rods may drive all the looms on one floor, and they should be placed at equal distances on the circumference of the wheel, to prevent the engine from being overloaded at one point.

The Society of Arts have very deservedly awarded to Mr. White for these various important improvements, their large silver medal and twenty-five pounds.

A model of the loom may be seen at the Society's Repository.

◆

SOLUTIONS OF MATHEMATICAL PROBLEM NO. V., VOL. XV., P. 63.

QUESTION—*Required to find the curve in which the difference of the subtangent and abscissa is to the abscissa, as the tangent is to the ordinate.*

By Δ (the Proposer).

Algebraically.

Using the differential formula, we have, by the problem,

$$\frac{ydx}{dy} - x : x :: y.\frac{\sqrt{dy^2+dx^2}}{dy} : y$$

$$:: \frac{\sqrt{dy^2+dx^2}}{dy} : 1$$

Hence $ydx - xdy = \sqrt{dx+dy^2}$

Square and reduce, $y^2dx - 2\,ydyx = x^2dx$

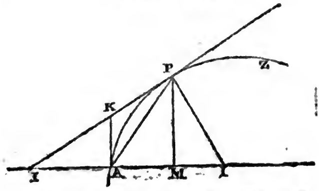
Or, $\frac{2\,ydy \cdot x - y^2\,dx}{x^2} = -dx$

Integrate, $\frac{y^2}{x} = \text{Constant} - x$

$= a - x$

Hence, $y^2 = ax - x^2$, where a, is the diameter of a circle, the required curve.

Geometrically.



AZ, the curve, A M = abcsissa, I P = tangent. P M perpendicular A M, the ordinate. Hence, by problem,

TA : AM :: TP : PM

Draw KA parallel to PM, and PI a normal at P. Then the angles KAP and KPA, are equal, also the angles KPI, KAM, are right angles; and, therefore, the remainders PAM, API are equal ∴ PI = AP. And since the point P may be taken any where in the curve, and the equation still holds true, the curve must be the circle.

[Answers to this question have been also received from LAB, and A Westminster Scholar.]

◆

ON THE CAUSE OF THE REPORT IN EXPLOSIONS.

Sir,—I take the liberty of sending you some remarks in answer to the question put forth by your correspondent, Mr. Baddeley, on the cause of report in explosions.

This is a subject on which much can be said, because there are so many kinds of sound; but I think we can observe three principal divisions, which I will try to point out. It is now universally acknowledged, that air is a real substance, i. e. *ponderable, impenetrable, inert,* capable of opposing resistance to, and striking against, any other body, either solid, liquid, or gaseous; of course, producing a sound more or less audible, according to the violence of the shock. 1st. sound is produced by the vibration of air; 2dly. by vacuum; 3dly. by the sudden eruption of compressed gas or steam* against the atmospheric air.

First Case. When you strike a bell, or pass a bow across the string of a violin, every one knows that the sides of the bell, and the string, begin to vibrate, and that the molecules of the air which are in contact, receive those vibrations and transmit them to our audition. The vibrations must be 32 per second to produce an audible sound.

Second Case. Wherever a vacuum is formed, air has a tendency to fill it; and if it can get in suddenly, a sound is produced; the experiment of the bladder tied over an open-topped receiver from which air is exhausted, affords us a striking example of this. If you fill a vial with steam, having previously driven the air out of it, and cork it tightly, or tie a thin bladder on the opening, and dip the vial in cold water as far as the neck, very soon a report is heard; because the steam being condensed, the air forces the cork in, and rushes into the bottle with a great noise. If you mix oxygen and hydrogen gases in certain proportions in a glassv essel, such as *a b*, which is open only at the end *b*, and suppose that these gases occupy the space *ai*, (the remainder being filled with water), the instant an electric spark runs through them a loud report is produced. Certainly no air can penetrate in the apparatus to occasion this report; but directly the spark passes, the gases *combine* and are converted into aqueous vapour at an excessively high temperature; this vapour occupies several hundred times more space than the gases *not combined*, and by its sudden expansion strikes violently against the sides of the vessel, and the surface of water *i*, and occasions that sound; the water is at the same time propelled downwards, and would be thrown out of the vessel if the vapour were not instantaneously condensed by its contact with the sides of the glass and the water below. This water rises directly to very near the top of the tube *a*. When this experiment is made with the instrument called Volta's Pistol, the sound is tremendous.

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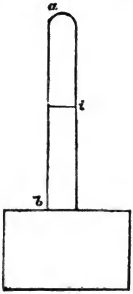
* It would be more proper to say, "steam raised to a high temperature."



Third Case. Let us consider now the third case, in which sound is produced by the collision of gases against gases. I range in this class the explosions of steam-boilers, thunder, bursting of any vessels filled with air, and a report of fire-arms, though this sound is perhaps more complex than any. It is known that air weighs from 14 to 15lbs. on every square inch of the earth; and if the rushing of air into the cannon after an explosion were the only reason of a report, it is evident that the sound would be always the same, as Mr. Baddeley observes: but no less than three causes occasion this report, viz. 1st. the powder being ignited, pushes the charge a little, and forms a small empty space where it instantaneously expands, repels out of the cannon the ball, wad, &c., and *strikes* against the column of atmospheric air which is at the mouth of the cannon; 2nd. the molecules of the fire-arm are thrown into violent vibration; 3rd. the air which was propelled comes back by its elasticity and rushes inside of the cannon, striking against the bottom with some force: these three sounds are so close to one another, that we only distinguish one. According to this, it is easy to explain why the sound is so much modified by various circumstances; whatever is done to facilitate the exit of the charge, such as greasing the cannon, dipping the wad in tallow, &c., adds to the loudness of the report. A cannon that is dirty or rusty inside never produces a very loud report, compared with another of the same size and kind, but clean and prepared in the way mentioned above. The inside of the piece being rough, the charge comes out with difficulty, destroys partly the elastic force of the gas, prevents its violent collision with the atmospheric air, and modifies the other conditions, beside rendering the gun liable to burst.

There cannot be any similarity in the explosion of gunpowder left loose on a board and fired, and the same quantity tightly bound up in paper. It might as well be asked, why a kettle that boils very fast does not explode like the boiler of a steam-engine? What could occasion a report in the first case, since there is no resistance? When the powder is wrapped up, the tighter it is bound up, the louder is the report. Gunpowder when fired has a volume 16 or 17 hundred times larger than in its first state; it possesses, consequently, very great elastic force, and if it has to overcome a great resistance its shock against the atmosphere is more sudden and more violent, and the report louder. The vacuum produced, in this instance, has little to do with the sound. The noise produced by a whip, by thunder, by the bursting of a bladder filled with air, by the explosion of a steam-boiler, &c., may also be explained on the same principle.

Yours, &c. A. Z.

London, Sept. 8, 1831.

◆

PRINCIPLES OF LOCOMOTION. SAXULA'S REPLY TO R. C., JUN., MR. CHEVERTON, AND "QUID."

"Where was Moses when the candle went out?"

Sir,—The opponents of my theory of locomotion seem to increase, and did I solely rely on that theory, I should, perhaps, be tempted to abandon it, on reading such papers as those by R. C., Jun., and Mr. Cheverton; but when I recur to my experiments, both with weights and with steam (on which experiments my theory is grounded), and when I find the reasonings and conclusions of those gentlemen utterly at variance with such experiments, I become more convinced that they are wrong, even if I am not right; and of my *general* correctness I have yet seen no reason to doubt.

My opponents will allow, that it is a waste of words to refute in detail positions, which have either been drawn from false premises, or terminate in false conclusions.

R. C.'s originate in false premises, Mr. Cheverton's end in false conclusions.

In reply to R. C., jun., (p. 375).

R. C. argues from false premises, inasmuch as he states, at page 376, that "a weight suspended from a horizontal spoke of the wheel" is an *external* power or force.

I have elsewhere shown, that internal and external power operate very differently—*internal* power only can be considered as locomotive. A power cannot be *external* whose immediate or ultimate point of support or re-action is any part or point of the machine itself. That only can be an external power which has a point of support and re-action *out* of the machine, which is, I presume, intended to be the case with the power *a n*, page 375, such as a man or horse pulling, or a weight working over a post in the ground. The "steam-engine at *x*," which is rightly called an *internal* power, and the weight "suspended from *a x*," which is erroneously called, and reasoned upon as an *external* power, have (each) their *ultimate* point of support and re-action at *c*, for the "re-action of the power against *x*," must ultimately be transferred in part to *c*, as would more clearly appear if the perch rested on another wheel forward, then also bearing part of the re-action at its *c*. I will thank R. C. Jun. to review his paper with these considerations, and communicate the result, as I have a doubt respecting some minor points of my theory, which his observations may solve. If I have been too brief, I will be more explicit; but he may rely upon it, that all force whose ultimate point of support or re-action is transferred to the points of the wheels in contact with the ground, or main fulcrum of locomotion, is an *internal* force, whether from weights, springs, or steam. I wish R. C. to consider my diagram at page 378, which accords with repeated experiments, and shows first an external force at D, and next an internal force at E and G, and also my machines at pages 407-409, which show internal forces only, likewise the diagram in this letter.

R. C. says, "*g* is the position where equal external and internal powers produce like effects." This is my maxim; my 5th proposition implies that an internal force has constantly the same effect as an external force at *g*. With an internal force *g* is always a constant point, or nearly so, because the ultimate point of *re-action* of an *internal* force is a constant point *always below the perch of the machine*, and its locality with respect to the machine very limited if not invariable; whereas, with an *external* force, the point of re-action is unlimited—it may be above the machine, and lift it off the ground, or oblique in any direction. This is very necessary for R. C. to consider, as I think he will prove my theory true. He will be my champion.

In Reply to Mr. Cheverton, (p. 309).

I am only solicitous to arrive at the truth, and I believe Mr. Cheverton is the same; but when I can see the fallacy of his locomotive reasonings, as plainly as I could those of Mr. Chapman, in page 251 (for 261) though they are more subtle, and too deeply involved, to admit of so ready an explanation, I by no means feel inclined to yield to them. If my theory be untrue, it is a pest to me, which I would gladly be rid of. I have said Mr. Cheverton's arguments end in false conclusions.

Mr. C. has put both Emerson and his locomotive diagram to the torture, to compel them to give evidence in favour of his assertions. He has changed *force* to *fulcrum*, and made a locomotive machine not locomotive.

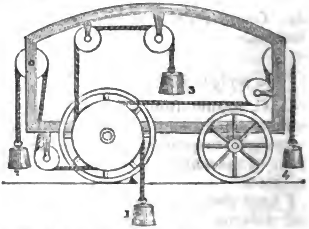
The humourist Mathews asks, "When is a nose not a nose?"—when 'tis a little radish (reddish)! and I may ask, "When is a locomotive machine not a locomotive machine?"—when it is a parallel ruler! like Mr. Cheverton's diagram!

Reductio ad Absurdum.

Mr. C. undertook to show me the way to London, and sorely was I puzzled on the road, as well I might be, but when we got there, sure it was dear Dublin, and no London at all, at all! If I did not treat such blunders jocosely, I should, perhaps, be unpleasantly severe. Emerson says, "Then the *force* applied within to move the machine, will be just the same as if the machine was at rest, and the object was to be moved." Saxula says so too; the *force* will be the same, neither more nor less, but the fulcrum, abutment, or point of re-action, will be different; Emerson says force, not *fulcrum*. If Mr. Cheverton and I (which Hercules forbid) wrestle together, and I push him down with a certain force, the abutment of that force will be at *my* feet; but if Mr. C. push me down with like force, the abutment will be at *his* feet, although our point of contact remains the same. The water repels the boat, or the boat repels the water. Mr. C. cannot overturn the "authorities," and here I close my remarks on the oar fulcrum.

I am now no longer puzzled—I admit fully the operation of his diagram, as he describes it, page 391; but I wholly deny, that it resembles in action a *locomotive* machine. He has pinned down the peripheries of the wheels *b p*, to the ground or plane; the un-locomotive reaction on these pins, and a composition of forces give the impulses he seeks for; but this is not *locomotive* action, it is common, or *statumotive* action (a new word). The rims of locomotive plain wheels have liberty to move backward, that is, to grind round in the ground, when pressed by strong power, and are not able to progress or move forward; his levers have no such option, as he will find, if he will merely *abut* them against the pins, and not through-fasten them. More, I need not say; and for better proof than any I can give, I request Mr. C. to make a carriage model with wheels, not too small, on the principle of his diagram, and this I require by way of reasonable fine for making such a blunder, and had I not "*contempt of court*" ringing in my ears, I should require our editor to be aiding and assisting at such model, because he especially sanctioned, at page 407, the said blunder. I have already made two models at Mr. C.'s request, partly by which I have convinced myself that his assertions are true, as regards statumotion; but false as applied to locomotion, respecting the principles of which Mr. Cheverton is (like Moses) in the dark.

My illustrative weights hang like dead weights about the faculties of my antagonists; I will, therefore, abandon them, and take to the more vivacious elasticity of springs, provided Mr. Cheverton, as a weight-parting-with favour, will tell me which of the four following equal weights (omitting all pulley friction) gives the most powerful locomotive or propulsive effect over the obstacle C; and this I seriously request as a clue to future observations. If Mr. C. has a doubt, he will gain much *locomotive* information, by making a model of the machine, which I advise him to do, both with barrel springs and weights.



Many eyes are upon him, and he must not now stop at trifles; experiments only can decide the contest; and if experiments prove me wrong, I am ever ready humbly to ask pardon for all the trouble I have given.

In Reply to "Quid," (*p.* 409).

To have to repel such pop-gun attacks as those of Quid is rather irksome; for, though he carries only blank cartridge, he swells the master-roll of my antagonists, and I will, in courtesy, return his fire.

> "For thee, fair science, welcome all the past,
> "For thee, fair science, welcome e'en the last."

If Quid had seriously read my papers, *I* think he would have given me credit for sufficient mechanical knowledge to free me from the "grievous" error of maintaining that *more work* could be done by long cranks than short ones.

A man cannot do more work with a lifting crane than without one; but he can do *such work* with a crane as without one he could not do. So by long cranks, levers, or wheel-gear, such as Quid describes, a carriage can mount a hill or overcome an obstacle that with short cranks it cannot do. For the reasons, I refer him to my theory—and so *this quid is chewed.*[*]

Yours, &c. SAXULA.

September 6, 1831.

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DESCRIPTION OF MR. HARRISON'S IMPROVED ESCAPEMENT AND FLY FOR TURRET-CLOCKS.

(*Concluded from last Number.*)

" *Of the Flies.*

"It need not be told that the use of clock-flies is to regulate the motion of the machinery, and is effected by means of wings, or vanes, fixed at the ends of arms, which, in revolving, beat against the air, causing such resistance to the motion as prevents it from becoming too rapid. Now, as the motion ought not to be checked until the proper degree of speed is attained, it follows that the manner in which clock-flies have hitherto been made is by no means well adapted to the purpose, seeing they have *fixed wings*, which consequently *always give resistance*—not merely when the motion becomes too rapid, but continually, even in some degree the moment the motion commences. The superiority of these improved flies is therefore obvious, since so long as their motion does not exceed the intended rate (to which they can be adjusted at pleasure, by tightening or slackening the spring), just so long will the wings cut the air with very little resistance; but the instant the motion becomes quicker than this, the same instant do the wings fly out and beat against the air, the centrifugal force becoming greater than the force of the spring.

"But although the advantage of flies on this principle over those of the common sort is evidently very considerable, yet it perhaps can only be justly appreciated by adding a few cursory observations. Taking for data, that a surface of a foot square impinging on the air at the rate of 100 feet in a second, will, at a mean temperature and density of the atmosphere, hold about 23lbs. in equilibrio, we find, by calculation, that the striking machinery of a clock with flies on this principle will not require quite so much as three-fourths of the weight that would be required with the best flies made in the common way; and yet it seems to appear that the real advantage is even greater than this. One great object to be overcome is *inertia;* this is so considerable as to be extremely felt in the striking machinery of a clock, and is indeed the point on which it almost entirely hangs; since, if it once gets duly in motion, there is no danger of its failing to perform its allotted number of blows.

"Now, the flies of a clock being the last and swiftest motion in the train, their command over the machinery is consequently very great. A power of two ounces at the end of the arm will frequently balance three hundred weight hung at the pulley, and sometimes considerably more, according as the descent of the weight may be more limited (and consequently greater weight required) by the local circumstances of the place. It is true that the resistance is inconsiderable at the commencement of the motion; but as it increases much more rapidly than the motion increases, it follows, that from the great effect it has, it must needs be severely felt at such a juncture as impressing motion on the machinery, so that a much greater weight is required to impress a sufficient motion on it before it begins to lift the hammer. On the contrary, my improved flies do not fly out, or (as we may call it) *open*, till after the hammer-lever drops off the roller in giving the first blow; and they also continually close during the lifting of the hammer afterwards, and only open for a moment on the speed increasing each time the hammer drops; whence they not only govern the motion the more effectually, but they require little more weight than what is merely sufficient to lift the hammer and overcome the inertia and friction.

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[*] Saxula would perceive from last Number, that he has still another "quid" to chew, and of a somewhat tougher sort than the one which he has here disposed of.—ED. M. M.

"*References to the Figures.*

"Fig. 4 (see last Number, pp. 449 and 451) is a front-view; fig. 5 a side-view; fig. 6 a back-view of the middle portion drawn larger; and fig. 7 a section, with the parts separated. *a*, the axis; *b*, the collar, or plate, in which it turns, and through which it projects enough to receive the fly. *c c*, the arms: *d d*, the wings, jointed to the arms at *e e*, which are cross-axes fitting in the cheeks *f f* of the wings. *g g*, two connecting-rods jointed to the wings at *h h*, and to the ears *i i* of the spring-box *j*. *k*, fig. 7, the hollow axis of the arms *c c*; this goes on the axis *a*, and on it is fitted the spring-barrel *j*, and its cap *l*. The pipe *k* forms the barrel-arbour; it is filed away on one side, so as to leave a stud *m* to hold the spring, the other end being, of course, attached to the barrel; the plate, with the ears *i i*, is fitted on the neck of the barrel, and lightly rivetted at *n*, so as to move freely on it. *o*, a ratchet-wheel round the barrel *j*; *p*, a catch screwed to one of the ears *i*. Now, when the spring-barrel is fitted on the fly-arms and put on the axis *a*, one may turn without the other; it is then followed by the ratchet-wheel *q*, which is squared on the axis *a*, and secured by the screw-nut *t*; this is engaged by the catch *r*, urged by the spring *s*, both attached to the arms *cc*. On turning the axis *a* round the way of the arrows in fig. 4, the ratchet-wheel *q* carries round the arms *c c* by the catch *r*; but when the axis *a* is suddenly stopped, the arms and wings can go on alone, till they have lost their momentum; while the arms revolve, the wings *d d* endeavour to open, as shown by the dotted lines *d d*. This is sufficiently restrained by the spring-barrel *j*. It is wound up by turning round the barrel fig. 6, and retaining it by the catch *p*. It then urges back the ears *i i*, and pulls the connecting-rods *g g*, thus holding the wings *d d* close. *u u* are stops which abut against the arms, and prevent their being pulled in more than to the circle of motion. The spring may easily be wound up so as to suit any given velocity; and when that is exceeded, the wings will fly open to beat against the air, pulling the ears *i i* to the dotted places *i i*, figs. 4 and 6, and winding up the spring so much more as they fly out, and returning them as the motion slackens."

Subsequently to furnishing the Society of Arts with the preceding descriptions, Mr. Harrison sent the Secretary the following letter, in which he supplies some omissions, and adds several interesting particulars illustrative of the value of his two inventions:—

"*Burton-upon-Trent, Feb.* 19, 1830.

"Sir,—There is an omission in my description of the escapement, which, should it not occur to the Committee, you will have the goodness to mention, namely, that the construction of the pallets is such as to admit of being adapted either to large or small arcs of the pendulum, according as the arms on the axes are shorter or longer, or as the pitch of the teeth of the wheel is greater or less in proportion thereto. I may add, also, that it requires to be set a-going a day or two before the effect of different weights becomes regular; and, I believe, a little fresh oil will make it rather irregular for a short time. From whatever cause this may happen, my son discovered it to be fact, and the case appears to be general in time-keepers, as on making any alteration they do not seem to settle immediately. Mr. J. D. Sollitt, who ascertained the rates of Christ Church clock, which I sent with the models, has two time-keepers, one sidereal and the other mean time: finding that his wooden rod pendulums (although rendered impervious to moisture, and compensated and otherwise managed according to the best of his judgment and information, resting on the most eminent trials, French as well as English), was not regularly affected by different temperatures; and a material having occurred to him which he conceived to be far superior for pendulum-rods, on putting these on at the commencement of the present year, he found the clocks were two or three days before their rates became steady. Since the application of these pendulums, however, those clocks go with a remarkable precision, as appears by the most accurate observations he can make with an excellent transit instrument. And to ensure the greater accuracy (as reading the time of the clock requires to be as instantaneous as possible), he frequently takes the transits of three different stars over the meridian the same afternoon or evening, and so takes the mean. On his informing me the material his new pendulum-rods are made of, I told him of the one I had devised, which seemed to please him better than his own. But I conceive his is not to be complained of, as, according to his register of the temperature of the air in his clock-cases, and of the rates of his clocks, since the 8th of the last month to the 11th of the present, his sidereal clock has not varied in its rate $\frac{1}{100}$ of a second. Not that it is possible to observe so near as perhaps $\frac{1}{30}$ of such truth; but the mean of his observations and computations gives this result.

"I am perfectly satisfied, however, that church-clocks are in some respects really better adapted for keeping time with precision than house-clocks are, partly because of the greater length of their pendulums, by which they describe a less arc with the same velocity of the bulb; and their greater weight, by which the effect of any variation in the density of the medium is proportionably lessened; and partly on account of the machinery being larger, by which greater proportional accuracy is attained in the execution, and, being less delicate, any variation in the fluidity of the oil has a less effect.

"Perhaps there is not any other escapement yet announced to the public that will bear so great an alteration in the weight with such a little effect on the arc and the time of oscillation, as those on the principle of the model I have sent; and I am persuaded, that had Christ Church clock one of my compensating-pendulums, instead of the common deal rod, it would measure time with any time-keeper; but they only wished to go to the price of a good common clock. Nevertheless, I esteem my other escapement to be considerably superior, but it is more delicate, and must not be introduced into a church-clock without a detached pallet-wheel, on account of the rough hands (in winding up, &c.) which church-clocks sometimes fall into. But by introducing a detached pallet-wheel, according to our mode of doing it, the part measuring time is reduced to this wheel only; which moving on small pivots, and being always actuated by an equal force, and not affected by the discharge of the other works in winding it up, continually impresses the same impulse on the pallets, although the weight hanging at the clock should vary from pounds to hundred weights, or whether the clock may have to drive the pointers of a dozen different dials variously situated, or no pointers at all. Indeed, I am firmly persuaded of the practicability of making a church-clock without any very extraordinary trouble or expense, that would not vary in its rate a single second in a long space of time. And were any premium to be offered for the cheapest, the most practicable, and best adapted time-keeper, on a proper scale for a thirteen feet or two seconds' pendulum (which I conceive to be best, a longer not being so manageable), that should measure time with the greatest precision, as was done with success in the case of the Liverpool and Manchester rail-way, I know my son would engage in the composition with the greatest confidence.

"It is somewhat extraordinary that he and myself should have both hit upon those pallets, of which we have sent the model, totally unknown to each other, and nearly at the same time. Pallets were wanted to a large church clock, and I had expressed a wish to introduce a superior kind; he therefore began to think about the matter. probably before I had leisure to do so. It was not long, however, before the plan occurred to me, and I made a working drawing thereof, which, on carrying to him to make, I was surprised at finding that he had almost got the self-same thing made of iron; though he has since used brass, as being easier to work, and not so liable to oxidate.

With respect to the flies for regulating the motion of the striking machinery, I mentioned, in my description, that those improved flies would only require about three-fourths of the weight that common flies require; but this is the least advantage that can be admitted. I know some clocks in which the artists, in order the more effectually to regulate the motion, have introduced such large flies as actually to require three times the weight that might have sufficed merely to lift the hammer, insomuch that, were the hammer to be taken off, the motion of the machinery would not be much increased. Indeed, this is a subject of greater magnitude than perhaps may be generally apprehended—the hammers necessary to bring forth the full sound of large bells being very considerable. The head of the hammer which strikes the hours on the 8th or tenor bell at Louth, in Lincolnshire, is 52lbs., and is lifted to such a height as to shake the whole place, frame, beams, &c.; indeed, the smallest of the quarter-hammers, which strikes on the least bell in the peal, is 24lbs., and its stroke is felt very strongly on the third bell-rope at the bottom of the tower (this being the only rope which comes to the bottom), although the bell-frame is 116 feet above: and the other quarter-hammer is, of course, considerably heavier. The hammer which strikes the hours at Doncaster is, I believe, nearly 70 pounds.

"When it is considered, that church-clocks are generally adapted to go eight days, and that in this space the hour-hammer has to give 1248 blows, and those of the quarters 3840 blows, including both hammers; it will easily be conceived that such hammers are not to be lifted to a considerable height such a great number of times without great weight, even with those improved flies, every other possible disadvantage being likewise removed; and, consequently, much less can this be done with common flies. Hence it is that few church-clocks scarcely bring forth half the full sound of the bells: for, though bells do really admit of yielding considerably more sound from the clock-hammers than from their clappers, yet, were the weight and fall of the hammers such as to produce the full sound, the connecting-apparatus and the flies being according to the usual mode, the weight would be enormous. Mr. Wynn makes mention of 17 cwt. being hung at the quarter part of a church-clock.

"I am, Sir, yours, &c.

"James Harrison.

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NEW PATENTS.

Brief Notices of Specifications Enrolled in 1831.

(Continued from p. 349.)

Ubiquious Shower Baths. *J. L. Benham, Wigmore-street.*—The improvement patented in this case, consists in making such an arrangement of pipes and reservoirs, that the bather may cause the water to shower or project upon him in any direction he pleases; either upwards, or downwards, or sidewards. The construction of a bath on this plan can be a matter of no difficulty to any one in the least acquainted with hydraulics. The mode pointed out by Mr. Benham, is, perhaps, as good as any, but not better than fifty others that might be suggested. Such a bath would probably be found of considerable use in the cure of particular local diseases.—*Date of Pat., Dec.* 13, 1830; *of Spec., June* 13, 1831.

"Species of Coal fitted for Refining and Purifying Sugar." *M. E. A. Pertius, Spinster, Paris.*—The new "species of coal," of which the patentee claims the invention, is a compost of many sorts, having, for their common characteristic, the union of animal and vegetable matter with clay, sand, and common salt. We select, for exemplification, the sort which she seems to recommend as best calculated to serve as a substitute for the ordinary bone-black in refining sugar. Of river sand take 250 parts, of clay 50, of salt (being first dissolved) 50, of gas tar, molasses, or blood, 100. Form the mass into cakes and dry them thoroughly in a coke furnace. The cakes are then to be taken out and ground to the requisite fineness. *Date of Pat., Dec.* 23, 1830; *of Spec., June* 23, 1831.

New mode of Preparing the Leaf of a British Plant for producing a healthy beverage by Infusion.—*Richard Abbey, of Walthamstow.*—The plant alluded to is hawthorn; the "new mode" of preparing its leaves, rincing in cold water, then steaming them till they change from green to olive, and finally drying them on hot plates. There is, we fear, nothing new in the proposition to employ hawthorn instead of genuine tea leaves; but, possibly, Mr. Abbey's mode of preparing them may be new. Mr. Abbey is said to have been once a wholesale tea-dealer, and must be supposed to know the usages of his former brethren in trade.—*Date of Pat., Feb.* 21, 1831; *of Spec., Aug.* 13, 1831.

New Mode of Fabricating Cloth, *Thomas Walmesley, Manchester, Manufacturer.*—The patent is stated to be for "improvements in the manufacture of cotton, linen, silk, and other fibrous substances, into a fabric or fabrics applicable to useful purposes." These improvements have for their object to supersede altogether the necessity of spinning and weaving. The cloth is to be manufactured in a way similar to felt. The cotton, or other "fibrous substance," after being teazed and carded in the usual manner, is to be laid out in two or more thin layers, one above the other, according to the thickness of the intended fabric. These layers are to be slightly pressed together; the united fleece is then to be thoroughly saturated by strong pressure, with any glutinous solution (by an apparatus similar to that employed in preparing cotton-yarn for warps); and the cloth is afterwards to be dried, and dressed by steam heat. The patentee describes the sort of machinery which he prefers for these different purposes. His patent is not, however, for that machinery, or any part of it, but generally for this mode of fabricating cloth, whatever may be the mechanical means employed. Mr. Walmesley seems not to be aware, that plans for manufacturing cloth on the same principle have been often tried before, both in this country and in America. He will perhaps be still less pleased to learn that they have uniformly failed. See Mech. Mag. vol. xii. p. 334. *Date of Pat.*, *Dec.* 13, 1830; *of Spec.*, *June* 13, 1831.

IMPROVEMENTS IN MACHINERY FOR GENERATING STEAM, *S. Dunn*, *Engineer*, *Southampton*.—The patentee professes to apply burning gas through the medium of vertical tubes to the interior of boilers for generating steam. Such an application of gas has been often before suggested—more than once in our own pages. See, particularly, Mech. Mag. vol. xi., p. 193).—*Date of Pat.*, *Feb.* 21, 1831; *of Spec.*, *Aug.* 20, 1831.

RAILWAY CARRIAGES, *R. Stephenson*, *of Newcastle-on-Tyne*, *Engineer*.- The present improvement of Mr. S. is confined to "the axles and parts which form the bearings at the centres of wheels which are to travel upon edge-railways." He now employs for each pair of wheels a sort of double axle, that is, a solid axle inclosed within a hollow casing, which serves the purpose of a supplementary axle. The solid axle goes through the hollow casing at each end, and supports on its extremities the weight of the carriage, while the wheels are fixed to the supplementary axle exclusively. The principal part of the pressure being thus removed from the solid or rotating axle, it works with less friction, and can be kept constantly lubricated with greater ease.—*Date of Pat.*, *March* 11, 1831; *of Spec.*, *July* 11, 1831.

(*To be continued.*)

NOTES WORTH NOTICE.

"The short and pithy anecdote has made more converts to knowledge than the longer and more elaborate essay; and the essay, in its turn, more than the abstruse and ponderous quarto."

Progress of Manufactures in Australia.—The following very interesting sketch of the State of the Useful Arts in this flourishing colony, is abridged from the annual speech of Sir John Jamison, the President of the Agricultural and Horticultural Society of New South Wales, as reported in the *Sydney Gazette* of October 16, 1830:—

"Mr. S. Lord, after many years' perseverance, has succeeded in manufacturing coarse cloth and blankets, which are very durable, and are readily sold to the extent of the supply. Mr. Robert Cooper, besides his splendid distillery, is engaged in erecting a building for the manufacture of cloth, and has sent to England for skilful manufacturers and machinery. His success cannot be doubted. It is amongst the drawbacks to our prosperity, that we have not yet manufactured all the coarse cloth, blankets, flannels, &c. necessary for our own use, and it may be apprehended, that the durability and superiority of our wool will not be known so as to be justly appreciated, until it is manufactured free from the mixture of inferior European wools.

"The manufactories of Messrs. Dickson, Wilshire, Mackie, and Aspinal, already make soap and candles, not only sufficient for the consumption of the population of New South Wales, but also for export to Van Diemen's Land. The soap, in quality, is allowed to be as good as the best English, and candles are approaching to European perfection. A discovery has been made by Mr. Mackie, that the ashes of the mangrove-tree, which grows wild on most parts of the sea-coast, are as good a sub-carbonate of soda as Spanish barilla, and these trees are so numerous, that the supply must be quite inexhaustible. The price of the best soap, in consequence of this advantage, ought never to be more than one farthing per pound above that of tallow, now from 2*d.* to 3*d.* per pound. In the course of last year only, Mr. Aspinal paid 1200*l.* for colonial barilla, used in his manufactory. To Mr. Wilshire is due the credit of establishing the first tan-yard; he last year tanned and manufactured 2000 hides, 5000 kangaroo-skins, 8000 sheep-skins, and 7 rolls of parchment of 60 skins each. Mr. W. has so many competitors, that there is enough leather prepared for colonial use, and a surplus of green hides exported to England; he last year paid no less than 500*l.* to persons for collecting mimosa-bark. Flax enough is obtained from New Zealand, at a cheap rate, for colonial purposes, and a surplus for exportation."

Sir John concludes this branch of his subject by emphatically observing, "I hope the period is not far distant, when we shall manufacture all the woollen goods we require,—distil our spirituous liquors,—brew as much beer as we want,—and, above all, make the whole of the wine and oil we stand in need of."

The newspaper from which we have quoted the above, is itself a proof of the advance of Australia; it is of as large a size, as well edited, and as well printed, as the most respectable of our English journals. It appears thrice a week.

Iron Manufacture in India.—The *Madras Government Gazette* contains a regulation, the first of 1831, passed by the Governor in Council, for granting to Josiah Marshall Heath, Esq., the exclusive privilege of erecting and using iron works on the European plan, within the Presidency of Fort St.-George, until the end of the present charter. Mr. Heath belongs to the Madras civil service, and, it appears, has employed many years, and a considerable part of his fortune in introducing iron-works into districts abounding in iron ore, but hitherto neglected for want of adequate means of raising and working them. To encourage him in his undertaking, the Governor has deemed it proper to grant him a temporary monopoly of the manufacture; every thing is done by monopoly in India.

Indian Cotton versus *American.*—The Agricultural Societies of Calcutta and Madras are laudably engaged in introducing varieties of the cotton-plant hitherto unknown in Hindostan. Experiments have proved that the Bourbon cotton succeeds well in Bengal; and some sea-island cotton, the growth of which has until now been engrossed by the Americans, has been produced in India from American seed, and exhibited to the Asiatic Society, which appeared to be equal, if not superior, to a sample of the original: from this strong hopes are entertained that we shall be able to drive Brother Jonathan out of the market. The great defects of the lands where it is grown are superabundance of salt, and a scarcity of fresh water; to remedy this, boring must be had recourse to: this has been tried at Fort William, but as yet unfortunately without success, notwithstanding the operation has been carried on to a great depth.

Scientific Periodicals of Italy.—Science is not totally neglected even in Italy. Two new journals have lately commenced their career; one, "Annals of Science in the Lombardo-Venetian Kingdom," is published monthly in Padua, immediately under the eyes of the Austrian Government; this, however, fills the place of two or three which have been discontinued for want of patronage: the other, "The Horticultural Review," which appears quarterly at Placentia, although its full title is very long and pompous, is a very small and flimsy work; that it cannot be very expensive is evident from the price, which is only half-a-crown per annum, yet it professes to give "reviews, with extracts, of every work on horticulture, published in Italy or elsewhere."

The First of August commemorated.—The opening of the New London Bridge has not passed without being celebrated in verse. Mr. Joseph Payne, the Barrister, has *privately published* a collection of "Lines" on the occasion, in which the names of all concerned, from the King down to the Water-Bailiff, are most ingeniously dovetailed into rhyme. Unfortunately in his hurry—for the poem was written, printed, and published, within ten days of the ceremony—our author actually forgot to introduce the Engineer and Contractors: on being reminded of the omission, however, he very laudably again mounted his Pegasus, and speedily brought out a second Part, in which not only Mr. Rennie, Sen. and Jun., Sir Edward Banks, and the *Reverend* Mr. Jolliffe, are duly lauded, but the principal personages at the laying of the first stone (in 1825) are particularized. The Corporation ought to revive the extinct office of City-Poet, if only for the sake of rewarding Mr. Payne for the *pains* he has taken, and the pleasure he has given them; at any rate, this effort ought not to *a-bridge* his chances of promotion.

Bartholomew Fair.—"A straw may show which way the wind blows."—At the last Bartholomew Fair, the joint attractions to one of the penny-booths were, a series of paintings of the Murder of Maria Marten, and a model of the Liverpool and Manchester Railway. It would be a curious subject of speculation, which attracted most visitors? It is rather strange, that while Zoological Gardens are the rage, the number of Menageries usually at the Fair was this year diminished. Have the beasts been taken to stock the said Gardens?

F. H.

ARITHMETICAL QUESTION.

The following arithmetical question was inserted some time since in Hone's Year-Book, but without any answer being obtained; better success will probably attend its appearance in the Mechanics' Magazine. W.

Problem. To divide any given number (say 2⅓) into 10 different numbers as follow:—The two first numbers are to be such, that if you square the sum of the greater and lesser it will equal the sum of the squares of each with twice the product of the two first. The next three numbers are to be such, that if you multiply the sum of the greater and lesser numbers by the next greater number, and to this product add the square of the lesser number, it will equal the square of the greater number. The next two numbers are to be such, that if to the square of their sum you add the square of the lesser number, it will equal the sum of the two multiplied by the lesser, to the double of which product you must add the square of the greater; also they are to be two such numbers, that if their product be added to the sum of their squares, it shall make a square number. The three last numbers are to be such, that if to the square of the sum of the two greater numbers you add the square of the lesser number, it will double the sum of the squares of the greater numbers; moreover, if you square the sum of the third and ninth numbers, and also add the sum of the squares of the fifth and eighth numbers, the sum of the squares of the whole shall be a square number, but if you cube the fourth, fifth, and eighth numbers, the sum of their cubes shall be a cube number. Required the ten numbers.—*Proposed by George Frederick Augustus Bridgeman.*

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WAGES AT MERTHYR.

Sir, I am surprised to see in the Mech. Mag., vol. xv., p. 262, a letter, signed a "Welch Tourist," which contains some statements very much calculated to mislead the public, in respect of workmen's wages at Merthyr and the adjoining iron works. It is there asserted, that at the time of the Tourist's visit, the workmen's wages amounted, on an average, to 23*s.* per week per man, and that as provisions were cheap at Merthyr, this was worth twice as much elsewhere. Now, Sir, being an old inhabitant of Merthyr, and for many years connected with the works in question, I assert, and defy contradiction, that the wages *do not amount to 15s. per week* on an average—and, instead of Merthyr being a cheap place, flour is 5*s.* per sack dearer than in Bristol, though the cost of carriage of a sack of flour from Bristol to Merthyr is only 2*s.* Your correspondent also speaks of a fine large castle having been erected as a residence for Mr. Crawshay; and of a pinery, that cost £850 per year; with a grapery, that costs nearly as much. But where, pray, did all the money for these expensive affairs come from? I am old enough to remember when Mr. Crawshay's grandfather (from whom he inherits Cyfarthfa Iron Works at Merthyr), was *coachman* to Mr. Bacon, the original founder and proprietor of the Works. How, then, did this coachman come to have so large an estate, so fine a castle, and so noble a pinery and grapery? Were they not all derived from the brows, pinched from the bellies, and scraped from the backs of the poor men employed? Mr. Crawshay has made a great noise against the Truck system, but—will it be believed?—he is now building a large shop, that he may give shop goods instead of money to his men, and in the face of that Bill that is just ready to issue from the House of Lords. An iron-master told me about six months back, that he had bought £2000. worth of pigs at 6*d.* per score, which he has cured, and now is forcing upon his workmen at 11*d.* per lb, instead of wages!—Yours, &c. JAMES KEMP, *Black Bear, Piccadilly, July*, 1831.

[We presume the "Coachman" did not come by his fortune through enchantment more than other people. Our Correspondent is pleased to trace the rise of the Crawshay family entirely to the labour of "the poor men they employed." But is the spirit of enterprise—the intelligence—the sagacity—the perseverance—by which that labour was directed to go for nothing? Persons in humble life should be the last (though we regret to say they are too often the first), to speak despitefully of the elevation of individuals of their own class; since, in nine cases out of ten, the individual is the architect of his own good fortune; and the rise of one man by honest means furnishes a ground of hope to all, that they may, by a proper exertion of the powers which Nature has given them, be equally successful.—ED. M. M.]

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MISCELLANEOUS.

Pure Oil for Chronometers.—Put about one gallon of good olive oil into a cast-iron vessel capable of holding two gallons; place it for one hour over a slow, clear fire, keeping a thermometer suspended in it; and when the temperature rises to 220°, check the heat, never allowing it to exceed 230°, nor descend below 212°; at the end of the hour the whole of the water and acetic acid will be evaporated. The oil is then to be exposed to a temperature of 30° to 36° for two or three days, till a considerable portion of it is congealed, and while in this state the whole is to be poured on a muslin filter, to allow the fluid portion to run through. This fluid portion is then to be filtered once or oftener through newly-prepared animal charcoal, grossly powdered, or rather broken, and placed on bibulous paper, in a wire, frame within a funnel; by this operation any rancidity that is present will be entirely removed, and the oil rendered perfectly bright and colourless. This process has been employed for several years with great success by Mr. Henry Wilkinson, of Pall Mall, and Messrs. Baraud and Sons, of Cornhill, who both agree in representing it as superior to every other mode of purification hitherto known. Mr. Wilkinson states that he does "not think it possible to render oil purer or better qualified for the required purposes, as no extraneous substance is introduced which can in the slightest degree injure its quality."

Pulpit Sounding-Boards.—In our 9th vol. p. 340, we gave from the Transactions of the Royal Society an account of a parabolic sounding-board, constructed by the Rev. J. Blackburn for the pulpit of the parish-church of Attercliffe-cum-Darnall, by means of which "the volume of sound is increased in a very considerable ratio, perhaps as 5 : 1, and is thrown powerfully as well as distinctly to the most distant parts of the church; so that whereas formerly the difficulty of hearing an intelligible sound was very great, now that difficulty is effectually removed." Professor Farish has since had a sounding-board put up on the same plan in his church at Cambridge, and he states that he "finds the power of it in increasing the sound far greater than he could have previously conceived." He adds, that when in the pulpit he "can easily hold a conversation with a person at the greatest distance in a low whisper."

Progress of Journalism.—The proportion which the number of journals in each quarter of the world bears to its population is as follows:—In Asia there is one paper for every 14,000,000; in Africa, one for every 5,000,000; in Europe, one for every 106,000; in America, one for every 40,000. And precisely in the same ratio is the comparative progress of civilization in these different divisions of the earth.—*Annales des Travaux des Sociétés des Statistique.*

[Not we think "precisely in the same ratio;" the Americans are certainly a very civilized people, but not, on the whole, so well-informed and enlightened as either the British, or French, or perhaps Germans. The author of this calculation has overlooked the influence which forms of government and fiscal systems have in checking or promoting the increase of journalism. Were the English taxes on paper and newspapers only taken off, it would probably be found, ere the lapse of a single year, that the number of journals had more than doubled.—ED. M. M.]

Absorption of Light.—Beccari made many curious experiments on the light which becomes visible on bodies being brought into a dark room after having been previously exposed to the sunshine. It appears from these experiments, that almost all inflammable bodies possess this quality in a greater or less degree. White paper or linen thus examined, after having been exposed to the sunshine, is luminous to an extraordinary degree; and if a person shut up in a dark room puts one of his hands out into the sun's light for a short time and then retracts it, he will be able to see that hand distinctly, and not the other.—*Tatler (the new Penny Paper of "Literature, Fine Arts, and Public Amusements," edited by Mr. Leigh Hunt; a journal deserving of universal encouragement, as well for the great talent with which it is conducted as for its singular cheapness.)*

Herm Granite.—A 4-inch cube of this stone was lately tried by Bramah's hydraulic-press, when it was found to require a pressure of 116 tons to crush it.

To make an Instantaneous Bleaching Liquid.—Put a small quantity of red lead into muriatic acid, when chlorine is instantly evolved; add water to the mixture, and then any thing inserted in it will have spots or stains, or its colour even, instantly removed.

Tension of Wrought Iron—It is surprising how much good bar will stretch before it separates; for instance, a piece of inch and quarter bolt of about two feet six inches long will sometimes be lengthened six inches, or twenty per cent., before it breaks. In the beginning of the experiment, the little oxidized portions of the outsides will scale off and drop down; and just before the bar breaks, the point where it is going to separate will be shown by a considerable contraction in the bar. The broken ends will be quite hot, latent heat being evolved by the texture of the iron having become closer, and the fibre appears harsher, smaller, and less silky than before the trial.—*Treatise on the Manufacture of Iron.*

LIST OF NEW PATENTS GRANTED, FROM THE 20TH OF AUGUST, TO THE 20TH OF SEPTEMBER, 1831.

Jacob Perkins, of Fleet-street, London, engineer, for certain improvements on his former patent, dated July 2, 1831; making the same applicable to the evaporating and boiling of fluids for certain purposes. Six months to specify, from 27th August, 1831.

Benjamin Aingworth, of Birmingham, button-maker, for an improvement in the working and constructing of buttons. Six months, 30th August, 1831.

Jean Jaques Jaquier, of Castle-street, Leicester-square, for certain improvements, communicated to him by a foreigner residing abroad, in the machinery for making paper which he denominates "Xeranothlipte." Six months, August 31, 1831.

Harrison Gray Dyar, of Panton-square, Middlesex, for an improvement in tunneling, or method of executing subterraneous excavations. Six months, September 5, 1831.

George Forrester, of Vauxhall Foundry, Liverpool, civil engineer, for certain improvements in wheels for carriages and machinery, which improvements are applicable to other purposes. Six months, September 5th, 1831.

William Bickford, of Tucking-mill, Cornwall, leather-seller, for an instrument for igniting gunpowder when used in the operation of blasting-rocks, and in mining. Six months, September 6, 1831.

James Neville, of Great Dover-road, Surrey, engineer, for an improved apparatus for clarifying water and other fluids. Six months, September 9, 1831.

George Holworthy Palmer, of Manchester-street, Gray's inn road, civil engineer, for certain improvements in the steam-engine and boiler and apparatus or machinery connected therewith, applicable to propelling vessels, carriages, and other purposes. Six months, September 16, 1831.

John Potts, Richard Oliver, and William Wainwright Potts, all of New Mills, in the county of Derby, engravers to calico-printers, and co-partners, for an improved method or process of obtaining impressions from engravings in various colours, and applying the same to earthenware, porcelain, china, glass, and other similar substances. Six months, September 17, 1331.

Sampson Mordan, of Castle-street East, Finsbury, engineer, and William Brockedon, of Devonshire-street, Queen-square, esquire, for certain improvements in the construction of writing pens and pen-holders, and in the method of using them. Two months, September 20, 1831.

Mark Cosnahan, of the Isle of Man, esquire, for certain improvements in apparatus, modes, or process for converting sea or salt water, and also other brackish, turbid, or impure waters, into purified or fresh water, which apparatus, modes, or processes, or parts thereof, may be applied to other purposes. Six months, September 20, 1831.

INTERIM NOTICES.

A Supplement to the present Volume, containing Titles, Preface, Index, &c. will be published on the 1st of November.

We decide in favour of "An Amateur." No such reward has been offered.

Mr. Henderson—with much pleasure, if he will inform us of some channel through which it can be conveyed to him free of expense.

The Remarks of the Ed. Vocis Rationis on the Reply of Trebor Valentine in our next.

"Logarithmus," who inquires after the instructions for laying down the lines on sliding rules, promised by Mr. Saddington, will soon be gratified by their appearance. They were sent to us a considerable time ago, but accidentally mislaid.

Will R. H. favour us with a specimen? To his condition there can be no objection.

Communications received from A. B. W.—Mr. Lacy—S. T.—An Emigrant—S. H.—Co-ordinate—Saxula—Julius—J. H.—Z.—W. W. F.—Mr. Sutton—J. B.

LONDON: Published by M. SALMON, at the Mechanics' Magazine Office, Wine-office-court, (between 145 and 146) Fleet Street, where Communications (post paid) are requested to be addressed.

M. SALMON, Printer, Fleet Street.

END OF VOL. XV.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

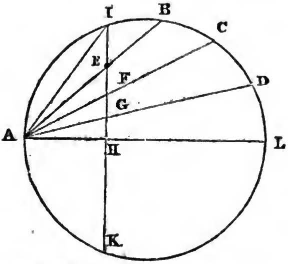
APPENDIX TO VOL. XIV.

ANSWERS TO MATHEMATICAL QUESTIONS PROPOSED IN VOL. XIV.

Question 1.—*By Mr. T. Hughes, Pupil, Mansion House, Hammersmith.* (p. 239.)

"If from any point A, in a given circle, any number of chords, AB, AC, AD, &c. be drawn; in AB take any point E, and divide the other chords in the points FG, &c. so that AC·AF, AD·AG, &c. be respectively equal to AB·AE; then will be the points EFG be in a straight line."

Answer by Mr. Thos. Hogan, Mathematical Tutor.



Draw the diameter AL, perpendicular to which draw IEH; now AC, AD, are divided in F and G, so that BA · AE = CA · AF = DA · AG, for $AI^2 = AH^2 + HI^2 = KE \cdot EI + HE^2 + HA^2 = KE \cdot EI + AE^2 = AE \cdot EB + AE^2 = AB \cdot AE$; similarly $AI^2 = CA \cdot AF = DA \cdot AG$ $\therefore$ $BA \cdot AE = CA \cdot AF = DA \cdot AG$.

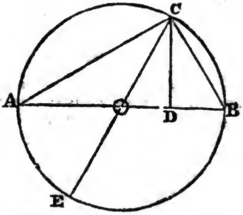
Q. E. D.

[Answers have been also received to this question from Mr. A. Finnie, Pupil, Kilmarnock Academy; Ixion; Nn; and Mr. J. Gilbert, jun.]

Question 2.—*By an Edinburgh Student* (p. 240.)

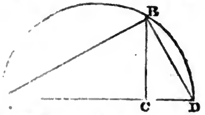
"To find the measure of a circular arc, so that its sine, added to the chord of its supplement, may be a maximum."

Answer by J. W.



Let CD be the required sine of the arc, and AC the chord of the supplement, 0 the centre of the circle, the radius = 1, and the chord CB = x. Then AC = $\sqrt{4 - x^2}$, and (Euclid 6 33.) CD = $\frac{x\sqrt{4 - x^2}}{2}$. Hence we have $\sqrt{4 - x^2} + \frac{\sqrt{4x^2 - x^4}}{2}$ a maximum, and $\frac{8x\dot{x} - 4x^3\dot{x}}{4\sqrt{4x^2 - x^4}} - \frac{x\dot{x}}{\sqrt{4 - x^2}} = 0$, which gives $x = 1$, consequently CB is the chord of 60°, the measure of the arc required.

By Mr. Thomas Hughes.



Let ABD be a semicircle, and BD the required arc. Draw BC perpendicular to AD, and join BA, BD; put AD = a AC = x, then BC = $\sqrt{ax - x^2}$, and AB = $\sqrt{AC^2 + CB^2} = \sqrt{x^2 + ax - x^2} = \sqrt{ax}$, Now by the question $\overline{AB+BC}$ is a maximum, that is, $\sqrt{ax}+\sqrt{ax-x^2}$ is a maximum. In fluxions $\frac{a\dot{x}}{\sqrt{ax}}+\frac{a\dot{x}-2x\dot{x}}{\sqrt{ax^2-x^2}}$ $= o$.

From this equation we find x to be $=\frac{3}{4}a$. Now BC $=\sqrt{ax-x^2}=\frac{a}{4}\sqrt{3}$ and AB $=\sqrt{AC^2+CB^2}=\frac{12a^2}{16}=\frac{2a}{4}\sqrt{3}=2$ BC $\therefore$ the angle BAC = 30° hence the arc BC is 60°.

[Answered also by Mr. Seymour and Mr. J. Gilbert, Jun.]

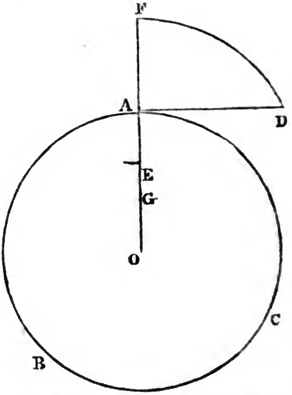
QUESTION 3.—*By Kinclaven.*

"Suppose the earth to be every where of the same density; it is required to find two points equidistant from its surface—the one above, and the other below—so that the force of gravity may be equal at both points, supposing the radius of the earth 3979 miles."

Answer by Amicus.

Assume 3979 (the radius of the earth) to be $=r$; $x=$ the distance above or below the surface, $g=$ force of gravity at the surface $\therefore r+x=$ distance from the centre of the earth to the required point above the surface, and $r-x$ to that below $\therefore$ by the principles of mechanical philosophy $(r+x)^2 : r^2 :: g : \frac{gr^2}{(r+x)^2}=$ force of gravity at the distance x above the surface of the earth, and $r : r-x : g :: \frac{g(r-x)}{r}=$ force of gravity at the distance x below the surface $\therefore$ by the problem $\frac{g(r-x)}{r}=\frac{gr^2}{(r+x)^2}$ and by reduction we have $x^2+rx=r^2$. And solving this quadratic, we obtain $x=\frac{r}{2}(\sqrt{5}-1)=2459{\cdot}15$ miles.

P. S.—The above problem admits of the following simple geometrical construction; the demonstration of which I propose as an exercise for some of your juvenile geometrical contributors.



Let ABC represent a great circle of the earth, O the centre; draw any straight line, OA, to the circumference; bisect OA in E, draw AD ⊥ to AO and = AO. From the centre E, and distance ED, describe the arc DF, meeting O A, produced in F. In A O take AG = AF. Then will F and G be the points required.

[Correct answers to question 3 have been also received from Mr. Hogan and Mr. J. Gilbert, jun., but the latter assumes $\overline{\frac{1}{1+d}}|^2=1-d$, without explaining how this equation is obtained.]

QUESTION 4.—*By G. S.*

"A and B, each stake 50*l.* on the highest of three throws with three dice. A throws first, and counts 43. B offers to give up his expectation to A for 5*l.* A refuses. Required the precise value of B's expectation."

Answer by the Proposer.

It is evident that, to throw three dice three times, the expectation will be same as with one throw with nine dice; also, it is demonstrated, by the writers on chances, that all the points, equally distant from the extremes—that is, from the least and greatest number of points upon the dice, have the same number of chances by which they may be produced.—Thus, since 54 is the highest number that can be thrown with 3 dice at 3 throws, or at one throw with 9 dice; hence the expectation of making the points 54, 53, 52, &c. to 43, will be the same as making the points 9, 10, 11, &c. to 20.

De Moivre has given the following formula for finding how many chances there are on any number of dice.

Let $P+1=$ number of given points to be thrown, $n=$ number of dice, $f=$ number of faces. Assume $P-f=q$, $q-f=r$, $r-f=s$, $s-f=t$, &c., and the number of chances will be

$$
\begin{aligned}
&+P\cdot\frac{P-1}{2}\cdot\frac{P-2}{3}\ \&\text{c.}\\
&-q\cdot\frac{q-1}{2}\cdot\frac{q-2}{3}\ \&\text{c.}\times\frac{n}{1}\\
&+r\cdot\frac{r-1}{2}\cdot\frac{r-2}{3}\ \&\text{c.}\times\frac{n}{1}\cdot\frac{n-1}{2}\\
&-s\cdot\frac{s-1}{2}\cdot\frac{s-2}{3}\ \&\text{c.}\times\frac{n}{1}\cdot\frac{n-1}{2}\cdot\frac{n-2}{3}\\
&+,\ \&\text{c.}
\end{aligned}
$$

Where the number of factors to be taken in each of the products $P.\frac{P-1}{2}.\frac{P-2}{3}$, &c. $q\cdot\frac{q-1}{2}.\frac{q-2}{3}$, &c. must be equal to $n-1$.

1st. To calculate the chances of throwing 43 or 20 at one throw with three dice.

Here $P+1=20$ ∴ $P=19$. $n=9$, $f=6$ ∴ $P-f=13$, $q-f=7$, &c.

$$
\begin{aligned}
19.\frac{18}{2}.\frac{17}{3}.\frac{16}{4}.\frac{15}{5}.\frac{14}{6}.\frac{13}{7}.\frac{12}{8} &= 75582\\
-13.\frac{12}{2}.\frac{11}{3}.\frac{10}{4}.\frac{9}{5}.\frac{8}{6}.\frac{7}{7}.\frac{6}{8}\times 9 &= -11583\\
&\overline{63999}
\end{aligned}
$$

That is, 43 or 20 may be thrown 63999 different ways at one throw with 9 dice. Proceeding in the same way, the chances of throwing 44, 45, &c. to 54 or 19, 18, &c. to 9, will be 39303, 22825, 11810, 6354, 2994, 1287, 495, 105, 45, 9, 1, the sum of which is 85228; and these chances are all favourable to B. Now, if B should throw 43, his chance of gaining will be equal to that of A ∴ all the chances in B's favour will be $85228+\frac{63999}{2}=117227\frac{1}{2}$

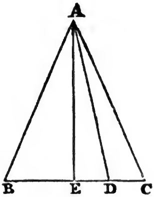
Now, all the possible throws that can be made with 9 dice $=6^9=10077696$

∴ $\frac{117227\frac{1}{2}\times 100}{10077696}=$ £1. 3*s*. 3¼*d*. is the value of B's expectation. So that A was right in refusing to give B 5*l*. for giving up his chance.

QUESTION 5.—*By Amicus.*

"If any point, D, be taken in the base, BC, of a plane triangle ABC and AD joined. Demonstrate that $AB^2\ DC + AC^2\ BD = (AD^2 + BD.DC)\ BC$."

Answer by Boyd Willock, Pupil, Kilmarnock Academy.



By Euclid, Book 2, Prop. 13 $AB^2 = AD^2 + DB^2 - 2\ BD \cdot DE$, and $2\ BD \cdot DE = AD^2 + DB^2 - AB^2$; and (Book 2, Prop. 12) $AC^2 = AD^2 + DC^2 + 2 DC \cdot DE$, and $2\ DC \cdot DE = AC^2 - AD^2 - DC^2$. Then, since $2\ BD \cdot DE = AD^2 + DB^2 - AB^2$, and $2\ DC \cdot DE = AC^2 - AD^2 - DC^2$ (B. 5, Ax. 1) $2\ BD \cdot DE\ (AC^2 - AD^2 - DC^2) = 2\ DC \cdot DE\ (AD^2 + DB^2 - AB^2)$ and dividing both sides by 2 DE; $BD\ (AC^2 - AD^2 - DC^2) = DC\ (AD^2 + DB^2 - AB^2)$ or $BD \cdot AC^2 - BD \cdot AD^2 - BD \cdot DC^2 = DC \cdot AD^2 + DC \cdot DB^2 - DC \cdot AB^2$, and $AB^2 \cdot DC + AC^2 \cdot BD = AD^2 \cdot DC + AD^2 \cdot BD + DC^2 \cdot BD + BD^2 \cdot DB = AD^2\ (BD + DC) + (BD \cdot DC).\ (BD + DC) = (AD^2 + BD \cdot DC)\ BC$. Hence $AB^2 \cdot DC + AC^2 \cdot BD = (AD^2 + BD \cdot DC)\ BC$—

Q. E. D.

[A correct answer has also been received from Amicus, who adds the five following corollaries.]

Cor. 1. If the point D should be in CB produced, then $AD^2 \cdot BC + AC^2 . DB = (AB^2 + DB \cdot BC)\ DC$.

Cor. 2. If $AB = AC$, the general theorem becomes $AB^2 . BC = (AD^2 + BD \cdot DC)\ BC$ or $AB^2 = AD^2 + BD \cdot DC$; which is a well known theorem.

Cor. 3. If $BD = DC$; then $(AB^2) + AC^2)\ \frac{BC}{2} = (AD^2 + BD^2)\ BC$, or $AB^2 + AC^2 = 2\ AD^2 + 2\ BD^2$, which is proposition A of the 2nd Book of Playfair's Euclid.

Cor. 4. If $AD = 0$, and consequently the point A coincide with D; then $BD^2 \cdot DC + DC^2 \cdot BD = BD \cdot DC \cdot BC$ or $BD^2 + BD \cdot DC = BC \cdot BD$, which is the 3rd proposition of the 3rd Book of Euclid.

Cor. 5. If AD is ⊥ to BC, then $AB^2 \cdot DC + AC^2 \cdot BD = (AB^2 - BD^2 + BD \cdot DC)\ BC$ or $AC^2 \cdot BD = AB^2 . BD - BD^2 . BC + BD \cdot DC \cdot BC$, or $AC^2 = AB^2 - BD \cdot BC + DC \cdot BC$, adding $2\ BD \cdot BC$ to both, then $AC^2 + 2\ BD \cdot BC = AB^2 + (BD + DC)\ BC$, or $AC^2 = AB^2 + BC^2 - 2 BD \cdot BC$ which is proposition 13th of the 2nd Book of Euclid. In the same way the 12th Prop. of the 2nd Book, and many other curious deductions, might be obtained from the general theorem.

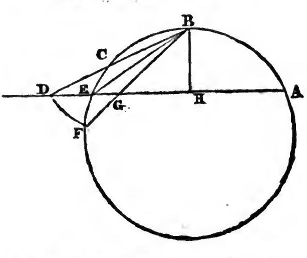
AMICUS.

[Answered also by Mr. Hogan—S. T. P.—and A Woolwich Scholar.]

QUESTION 6.—*By Mr. Chas. Hughes, Pupil, Mansion House, Hammersmith.*

"If from the bisection of a given arc of a circle, as a centre, any circle be described cutting the circumference of the given circle and the chord of the given arc produced, and the point of bisection joined to the two points of intersection, then will these two straight lines be divided into two segments, the greater of the one equal to the greater of the other and the less to the less."

Answer by Mr. Hogan.



Let EBA be the given arc, B its bisection; from the centre B describe the arc DF cutting the chord produced in D and the periphery of the given circle in F, join BD, BF; now we have to prove $BC = BG$ and $CD = GF$, for $BD^2 = DH^2 + HB^2 = AD \cdot DE +$

$HE^2+HB^2=AD\cdot DE+BE^2 \therefore BD^2-AD\cdot DE=BE^2=AG\cdot GE+GB^2=BG\cdot GF+GB^2=FB\cdot BG$, but $BD^2-AD\cdot DE=BD\cdot DC+BD\cdot BC-AD\cdot DE=BD\cdot BC \therefore BD\cdot BC=FB\cdot BG$, but $BD=FB \therefore BC=BG$ and $CD=GF$.

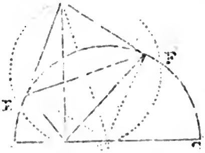
Q. E. D.

[Answered also by the Proposer, and Mr. A. Finnie, Kilmarnock Academy. H. O. who has favoured us with an answer, has mistaken the nature of the question, and not solved it correctly, even according to his own view of it.]

QUESTION 7.—*By Mr. George Webb.*

"If from any point without a semicircle two tangents be drawn, and also a perpendicular to the diameter, then will the angle formed by the two straight lines, drawn from the point where the perpendicular meets the diameter to the points of contact, be bisected by the perpendicular. Demonstration required."

Demonstration by Mr. J. Gilbert, Jun.



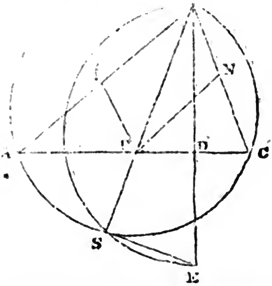
Let DEFG be the given semicircle, of which C is the centre; from any point A without the semicircle draw AB perpendicular to the diameter DG, draw the tangents AE, AF, and join BE, BF, the angle EBF will then be bisected by AB. For join CA, CF, CE, EF, then (Euc. 3·16) the $\angle$s AEC, AFC are right $\angle$s, and since ABC is also a right $\angle$. hence (Euc. 3·31) the points A, E, B, C, F, are in the circumference of a circle whose diameter is AC. Now $\angle CEF = CFE$ (1·5) $\therefore \angle AEF = AFE$, also (3·21) $\angle ABE = AFE$ and $\angle ABF = AEF$, $\therefore \angle ABE = ABF$, or the $\angle$ EBF is bisected by AB.

[Answered also by Mr. Hogan and Juvenis.]

QUESTION 8.—*By Zeno.*

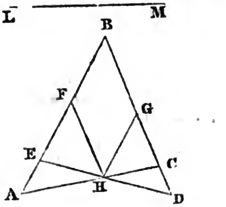
"To find a point D in the base of AC of a given triangle ABC, so that by drawing DE, DF, respectively parallel to BC, BA, the sum of the rectangles AB, BE, and CB, BF, may be equal to a given space.

Answer by Mr. Thomas Hughes.



Let ABC be the given triangle, and ABCD its circumscribing circle. Draw the perpendicular DB which produce to E, making $EB\cdot BD=$ the given space. On BE, as diameter, describe the semicircle BDE, cutting ABCD in S; join SE; join SB cutting AC in P; draw PM, PN, parallel to BC, AB; then is P, the required point in the base. Since the angle BSE is an angle in a semicircle, it is a right angle; also by construction, PDE is a right angle; the four points S, P, D, E, are situate in the circumference of a circle $\therefore EB\cdot BD$ (which is equal to the given space) $=SB\cdot BP=BP^2+BP\cdot PS=PB^2+AP\cdot PC$; but it is proved, in Proposition I, Stewart's General Theorems, that $PB^2+AP\cdot PC=AB\cdot BM+CB\cdot BN \therefore AB\cdot BM+CB\cdot BN=$ the given space; hence P is the required point.

By Mr. A. Finnie, Pupil, Kilmarnock Academy.

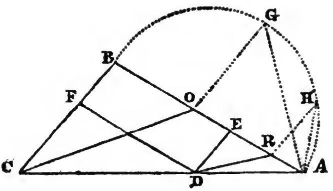


Take BE a third proportional to

AB, and LM, and BD a third proportional to BC and LM, join ED, the point H, where ED cuts the base is the point required; draw HF and HG respectively parallel to CB and BA. Then $AB \cdot BE = BC \cdot BD$ because each is equal to LM^2, and (Euc. B. 5) $AB : BC :: BD : BE :: DG : GH$, hence $AB \cdot GH = BC \cdot DG$; but $GH = BF$, hence $AB \cdot BF = BC \cdot DG$. Then since $LM^2 = AB \cdot BE = AB \cdot BF + AB \cdot FE$. And LM^2 also $= CB \cdot BD = CB \cdot BG + CB \cdot DG$, then (adding) $2 LM^2 = AB \cdot BF + CB \cdot BG + AB \cdot FE + CB \cdot DG$; but $AB \cdot FE + CB \cdot DG = AB \cdot FE + AB \cdot BF = AB \cdot BE = LM^2$. Hence $AB \cdot BF + CB \cdot BG = LM^2$, therefore, the point H is found such, &c. &c.

Remark—Since the point H is to be *in the base*, LM^2 must not be greater than the square of the greater side HB, nor less than the square of the other side BC; for it is evident that the greatest sum of the rectangles is less than AB^2, when the point is in the base, and the least sum greater than BC^2. And since AB is greater than LM, BE must be less than AB, and since BC is less than LM, BD must be greater than BC; consequently, the points E and D, must be on different sides of the base AC; therefore ED, which joins these points, will cut the base. When the triangle is isoceles, any point in the base will do, and LM can have only one value.

By R. C., Jun.



Let $CB = a$ $AD = x$
$AC = b$ $DC = b - x$
$AB = c$ $r^2 =$ given space.

$$\text{Then } b : c = b - x :: \frac{c}{b} (b\ x) = DF$$

$$\text{And } b : a = x :: \frac{a}{b} x = BF$$

$$\text{By hyp. } \frac{c^2}{b} (b - x) + \frac{a^2}{b} x = r^2$$

$$\therefore c^2 b - c^2 x + a^2 x = br^2$$

$$\therefore x \left\{ c^2 - a^2 \right\} = b \cdot \left\{ c^2 - r^2 \right\}$$

$$\therefore b : x = c^2 - a^2 :: c^2 - r^2$$

Hence on c (= AB) describe a semicircle, with radii BC and r, and centre B, describe arcs cutting BGA in G and H, demit the perpendiculars GO·HR. Join CO and draw DR parallel to OC, cutting the base in D; D is the required point; for $AC : AD = AO :: AR =$ (E. 6·18) $GA^2 : HA^2 = BA^2 - BG^2 :: BA^2 - BH^2$. Cor. $\left\{ \begin{matrix} a - x : x \\ DC : DA \end{matrix} \right\} = r^2 - d :: c^2 - r^2$; whence it appears that r must be greater than BC and less than AB, in order that D may fall within the base AC.

Question 9.—*By Professor Porson.*

“ To find all the possible values of x, y, z. and w.”

Answer by Mr. Charles Hughes, Pupil Mansion-House, Hammersmith.

From the 1st equation we have $xy = 444 - zw$, and from the 4th $xy = \frac{5184}{zw}$ $\therefore$ $444 - zw = \frac{5184}{zw}$, or $z^2w^2 - 444zw = -5184$. Solving this quadratic, we obtain $zw = 432$ or 12, in the same the value of yw from the 2nd and 4th will be $= 144$ or 36, and from the 3rd and 4th $yz = 108$ or 48. 1st. Suppose $zw = 432$, and $yw = 144$ $\therefore w = \frac{432}{z}$ and $w = \frac{144}{y}$ $\therefore$ $\frac{432}{z} = \frac{144}{y}$, from which $z = 3y$ $\therefore yz = 3y^2 = 108$ or 48, and $y^2 = 36$ or 16 $\therefore$ $y = 6$ or 4, and $w = \frac{144}{y} = 24$ or 36, and $z = 3y = 18$ or 12, and $x = \frac{444 - zw}{y} = \frac{12}{6}$ or $\frac{12}{4} = 2$ or 3

2nd. Suppose $zw = 432$ and $yw = 36$, proceeding as above we find $y = 3$ or 2, $z = 36$ or 24, $w = 12$ or 18, and $x = 4$ or 6. 3rd. Suppose $zw = 12$ and $yw = 144$, by the same process as above we obtain $y = 36$ or 24, $z = 3$ or 2, $w = 4$ or 6, and $x = 12$ or 4. Lastly, supposing $zw = 12$ and $yw = 36$, then will y be found to be $= 18$ or 12, $z = 6$ or 4, $w = 2$ or 3 and $x = 24$ or 36, therefore the corresponding values of x, y, z, w, will be as under:—

$$\begin{array}{rrrrrrrrr}
x = & 2, & 3, & 4, & 6, & 12, & 18, & 24, & 36 \\
y = & 6, & 4, & 3, & 2, & 36, & 24, & 18, & 12 \\
z = & 18, & 12, & 36, & 24, & 3, & 2, & 6, & 4 \\
w = & 24, & 36, & 12, & 18, & 4, & 6, & 2, & 3
\end{array}$$

The above values of x, y, z, and w, may be all considered as negative quantities $\therefore$ the problem admits of sixteen possible answers.

[Answers to this question have been also received from Mr. Hogan, Mr. Russel, Philo-Porson, C. J. C., and Tresmigistus, but all more or less defective; the writers giving two or three sets of solutions only, whereas the difficulty on which the merit of the problem turns, consists in giving *all* the possible values of x, y, z, and w.]

TABLE OF STEAM VESSELS EMPLOYE

Their Length, Depth, &c., Dimensions of thei

	Name of vessel.	Engines made by	Diameter of cylinder.	Length of stroke.	Diameter of paddle wheels.	Length of Floats.	Depth.	Number of paddles.	Number of revolutions made by engine.	Boiler.			Number of Fire Places.	Where built, &c.
										Length.	Width.	Depth.		
1	H.M.S. Etna	Fawcett and Prestons	46	4 3	17 3	8 3	2 4		23	25	16	9 6	6	Liverpool
2	Comet	H. Maudslay	46½	4 6		8 3	1 7½	14					4	—
3	Dolphin	Boulton, Watt, & Co.												Harwich
4	Thetis	—												—
5	Sybil	Fawcett and Prestons	37	3 6	14 6	7								Liverpool
6	Leeds	—	45	4	18 6	6	2	16	21½	20	20 4			—
7	Hibernia	—	45	3 9	17 6	6 6	2	16	23	22	18			—
8	Mersey	—	38	3 6	15	6 6	1 10	14	25	18	18		4	—
9	Mona	—	40	4	16 2	6 9	1 10	16	22	21	16 10		4	—
10	City of Dublin	—	45	3 6	16	6	1 6	14	24	22	18			—
11	Town of Liverpool	—	45	3 6	18	4	2		23	22	18			—
12	Birmingham	—	45	4	19 6	6	2	16		20	20 4	9 0	6	—
13	Nottingham	—	45	4	18 6	6	2	16		20	20 4	9 0	6	—
14	Gipsey	—	45	4	17 6	7 6	1 10							—
15	Clyde	—	43	4	18	7	1 10	16						—
16	Nora Creina	—	43	4	18	7	1 10	16	24	21	18			—
17	Shamrock	—	37	3 6	15	6 6	1 10	14	26	17	17			—
18	Lee	—	43	4	18	7	1 10	16	24	22	18			Chester
19	Severn	—	43	4	18	7	1 10	16	24	22	18			Liverpool
20	St. George	—	42	3 6	17	6 6	1 10		24	22	18			—
21	Emerald Isle	—	46½	4	18	7 6	2		24	23	18	9 6	5	—
22	Lord Roden	—	43	4	18	7	1 10	16		21	19			—
23	Innisfail	—	43	4	18	7	1 10	16		21	19			—
24	St. David	—	34	3	14	5 6								—
25	Prince Llewelyn	—	34	3	14	5 6								—
26	James Watt	—	37	3 6	14	6 6	1 10	14						—
27	Henry Bell	—												—
28	George IV.	—	43	4	17 4	7	1 10	16						—
29	John O'Gaunt	—												—
30	Erin	—	46½	4 9	18 6	8 6	2 6		21	21	21	9 6	6	—
31	Avon	—	43	4	18	7	1 10							—
32	Commerce	H. Maudslay	46½	4 6	17 4	7	2 1	14	25	24	18		5	—
33	Solway	Boulton, Watt, and Co.												Holyhead
34	Cumberland	—												—
35	Britannia	Gladstone and Foster	46	4	17 6	6 6	1 10	16	22	20	20 4		6	Liverpool
36	Manchester	—	46	4 3	19	6	1 10	16	22					—
37	Sheffield	—	46	4 3	19	6	1 10	16						—
38	William Huskisson	Scott, Sinclair, and Co.	42½	4	18	6 4	1 10	16	24					Greenock
39	Town of Drogheda	—	42½	4	18	6	1 10	16						—
40	City of Glasgow	Napier	40	3 6	15 6	7	1 10							—
41	Majestic	—	40	3 6	14									—
42	Chieftain	—												Port Glasgow
43	Corsair	—												—
44	Lord Blaney	Clegg and Co.	42	4	18	6	1 10	14	20					Liverpool
45	St. Patrick	—	42	4	18	6	1 10	14						—
46	City of Londonderry	—												—
47	Ormrod	Ormrod												Chester
48	Enterprize	—												—
49	Cork Packet	—												—
50	Countess of Londale	Clegg and Co.												Whitehaven
51	Liffey	—												Liverpool
52	Frolic	Scott, Sinclair, and Co.												Greenock
53	Kingstown	Clegg and Co.												Chester

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IN ST. GEORGE'S CHANNEL,

Machinery, Consumption of Fuel, &c.

By whom.	Length.	Beam.	Depth of hold.	Draft of water.	Description of vessel.	Whether ready or building.	Trade employed in.	Owners.
Humble and Hurry	126	22 6	14 6	11	Sp.	Ry.	Liverpool & Dublin	Post Office
—	126	22 6	14 6	11	S	R	—	—
Graham					S	R	—	—
—					S	R	—	—
Humble and Hurry					S	R	—	—
Wilson	140	25	15	10	S	R	—	City of Dublin Co.
Dawson and Pearson	133	22 6	14	11	S	R	—	—
Grayson and Leadley	130	22	13	9 6	Ft.	R	—	—
Mottershead and Hayes	126	20 6	14	11 6	S	R	—	—
Dawson and Pearson	133	22 4	14	11	S	R	—	—
Wilson	133	22 6	14	11	S	R	—	—
—	140	25	15	10	S	R	—	—
—	140	24 8	14 8	11	S	Bg.	—	—
Mottershead and Hayes	140	22 6	16	11 6	S	B	—	Sir John Tobin
W. Seddon and Co.	140	24	16	10 6	F	B	—	City of Dublin Co.
—	140	22 4	16	10 6	F	R	Waterford & Bristol	Waterford & Bristol S.N.C.
Bland and Chaloner	120	24	13	10 6	F	R	Belfast & Liverpool	City of Dublin Co.
Wilson	130	22	13 6	11	F	R	Cork and Liverpool	St. George Company
—	130	22	13 6	11	F	R	Cork and Bristol	—
Dawson and Pearson	133	22 6	13 8	11	S	R	—	—
Mottershead and Hayes	150	23	14	12	S	R	Dublin and Bristol	—
Smyth and Co.	140	23	15	9 6	F	R	Lpool. & Dundalk	—
Mottershead and Hayes	130	22 6	14	10 6	F	R	Cork and Dublin	—
Humble and Hurry	110	17 6	11	9	F	R	—	—
Wilson	110	18	12	9	S	R	Lpool. & Beaumaris	—
Humble and Hurry	110	19 6	12	10	F	R	Lpool. & Greenock	Mersey & Clyde Steam Co.
Wilson	110	18	12	10	F	R	—	—
Haseldon	125	22	13 6	9 6	F	R	Liverpool & Newry	Newry Company
Smith and Co.					F	R	Lpool. & Lancaster	—
Rathbone	140	25	15	12	F	R	London & Belfast	Belfast Company
Smith and Co.					F	B	—	St. George's Company
Grayson and Leadley	144	22	16 6	11	F	R	Liverpool & Dublin	City of Dublin Co.
—	133	21 6	15 6	9 6	F	R	Liverpool & Carlisle	Liverpool and Carlisle Co.
—	133	21 6	15 6	9 6	F	R	—	—
Dawson and Pearson	133	24 6	14	11	S	R	Liverpool & Dublin	City of Dublin Co.
—	140	24 8	14 6	11	S	R	—	—
—	140	24 8	14 6	11	S	R	Liverpool & Belfast	—
Scott and Sons.	140	24	14 6	9 6	F	R	Lpool. & Greenock	Mersey and Clyde Co.
Simmonds					S	R	—	Drogheda Company
Scott and Sons.	130	22 6	14	9 6	S	R	—	Scotch Company
—	140	23	14	10	S	R	—	—
Carsewell					F	R	Liverpool & Belfast	Mr. Langtry
Wood				10	S	R	—	—
Rathbone	130	22	15	11	F	R	Liverpool & Newry	St. George's Company
Clarke and Co.	130	22	13 6	11	F	R	Dublin & Bristol	—
Haseldon							Lpl. & Londonderry	Londonderry Company
Wilson							Lpool. & Beaumaris	George Daney
—							—	—
—	130	22 6	13 6		F	B	—	St. George's Company
—						R	Lpl. & Whitehaven	Whitehaven Co.
Rathbone	133	22	13	10	F	R	Liverpool & Dublin	City of Dublin Co.
Scott and Sons							—	Scott and Sons.
Wilson						R	—	St. George's Company

Name.	Employment.	By whom built.	Engines made by	Power of Engines.
Francis	Woodside Ferry	Lomax and Wilson	Fawcett and Prestons	From 20 to 25 horse power.
Hercules	—	Bland and Chaloner	—	
St. David	—	—	—	
James	Birkenhead Ferry	Mottershead and Hayes	—	
Britannia	—	—	Dove and Co.	
Vesuvius	—	Humble and Hurry	—	
Etna	—	Dawson and Co.	Fawcett and Prestons	
Seacombe	Seacombe Ferry	Mottershead and Hayes	Dove and Co.	
Alice	—	—	—	
Lady Stanley	Eastham	—	—	
Maria	Ellesmere	Wilson	Rigby and Co.	
Eclipse	Runcorn	Rathbone	Fawcett and Prestons	
Duke of Bridgewater	—	Wm. Seddon and Co.	Dove and Co.	

BOATS FOR TOWING.

Manchester	—	—	—	From 20 to 40 horse power.
Mars	—	Lomax and Wilson	Fawcett and Co.	
Venus	—	Wm. Seddon and Co.	—	
Harriet	—	Humble and Hurry	Rigby and Co.	
Victory	—	—	Gladstone and Foster	
John Bull	—	—	Fawcett and Co.	
Abbey	—	—	Dove and Co.	
Jonathan Hulls	—	—		
Earl of Bridgewater	—	Wm. Seddon and Co.	—	
Satelite	—	Rathbone	Fawcett and Co.	

LIST OF NEW PATENTS SEALED IN 1830.

Continued from Supplement to Vol. XIII.

J. Ericsson, of the New Road, engineer, for an improved engine for communicating power for mechanical purposes.—24th July. Six months to specify.

A. Garnett, of Demerara, Esq. for certain improvements in manufacturing sugar.—24th July. Six months.

S. Roberts, of Park Grange, near Sheffield, for certain improvements in plating or coating of copper or brass, as also a method for making such kinds of articles or utensils with the said metal, when so plated.—26th of July. Two months.

R. Ibotson, of Poyle, Middlesex, for an improvement, or improvements, in the method or apparatus for separating the knots for paper stuff or pulp, used in the manufacture of paper.—29th July. Four months.

J. Ruthven, of Edinburgh, for an improved machinery for the navigating of vessels and propelling of carriages.—5th August. Six months.

J. Down, of Leicester, for certain improvements in making gas for illumination, and in the apparatus for the same. —5th August. Six months.

J. Street, of Clifton, Gloucestershire, for a new mode of obtaining a rotary motion by water, steam, or gas, or other vapour; being applicable to the giving blasts to furnaces, forges, and other purposes, where a constant blast is required. —5th August. Two months.

W. Dobree, of Fulham, for an independent safety boat of novel construction. —5th August. Six months.

W. Lane, of Stockport, Chester, for certain improvements in machines, which are commonly known among cotton spinners by the names of roving frames, or otherwise called cove frames, or bobbin and fly frames, or jack frames.—5th Aug. Four months.

T. Hancock, of Goswell Road, for improvements in the manufacture of certain articles of dress or wearing apparel, fancy ornaments, or figures.—5th August. Two months.

W. Mallet, of Marlborough Street, Dublin, for certain improvements in making or constructing certain description of wheelbarrows.—5th August. Six months.

J. Pearse, of Tavistock, Devon, for an improved method of making and constructing carriage wheels, and in the application thereof to carriages.—5th August. Six months.

C. Shiels, of Liverpool, for certain improvements in the process of preparing and cleansing rice. Communicated by a Foreigner.—5th August. Six months.

Æ. Coffey, of the Dock Distillery, Dublin, for certain improvements in the apparatus or machinery used in the process of brewing and distilling.—5th August. Six months.

M. Robinson, of Great George Street, Westminster, for certain improvements in the process of making and purifying sugars. Communicated by a Foreigner. —5th August. Six months.

R. Clough, of Liverpool, for an improved supporting block, to be used in graving docks, and for other purposes. 5th August. Six months.

Sir C. Webb Dance, of Hertsbourne, for certain improvements in packing and transporting goods.—5th August. Six months.

S. Smith, of Princes Street, Leicester Fields, for a new nipple or touch-hole, to be applied to fire arms for the purpose of firing the same by percussion; and a new cap or primer for containing the priming, by which such fire arms are to be fired.—7th August. Two months.

W. Palmer, of Wilson Street, Finsbury Square, for improvements in making candles.—10th August. Six months.

J. Lawrence, of Birmingham, and W. Rudder, of Edge, Gloucestershire, for an improvement in saddles and girths by an apparatus affixed to either of them.— 10th August. Six months.

T. Ford, of Canonbury Square, Islington, for certain improvements in the medicine for the cure of coughs, colds, asthmas, and consumptions, known by the name of "Ford's Balsam of Horehound." —12th August. Two months.

J. Knowles, of Farnham, Surrey, for a certain instrument or machine for drawing up hop poles out of the ground, previous to picking the hops; and which, by drawing the poles perpendicularly, will greatly save them, as well as prevent the hops from being bruised, called "a hop-pole drawer by lever and fulcrum."—Two months.

M. Towgood, of Dartford, Kent, and L. Smith, of Paternoster Row, London, for an improved mode of applying size to paper.—18th August. Six months.

Major-General Gubbins, of Southampton, for certain improvements in propelling and giving motion to machinery.—18th August. Six months.

S. R. Bakewell, of Whiskin Street, Clerkenwell, for certain improvements in machinery, apparatus, or implements to be used in the manufacture of bricks, tiles, and other articles to be formed or made of clay, or other plastic materials. Partly communicated by a Foreigner.—18th August. Six months.

W. Mason, of Margaret Street, Cavendish Square, for improvements in axletrees and their boxes.—24th August. Six months to specify.

T. Barratt, of St. Mary Cray, Kent, for improvements on machinery for making paper.—31st August. Six months.

A. Applegath, of Crayford, Kent, Printer, for improvements in printing machines.—31st August. Six months.

W. Losh, of Benton House, Northumberland, for improvements in wheels for railway carriages.—31st August. Six months.

E. Budding, of Stroud, Gloucestershire, for machinery for the purpose of cropping or shearing grass plats, &c., being a substitute for the scythe.—31st August. Two months.

E. Clayton, of Nottingham, for an improved mode of manufacturing dough for baking into bread.—31st August. Two months.

T. Thacher, of Birmingham, for an elastic self-adapting saddle.—7th September.—Six months.

J. Hanson, of Huddersfield, Yorkshire, for improvements on locomotive carriages.—31st August. Six months.

P. Williams, of Holywell, Flintshire, for an apparatus for preventing accidents in carriages, instantly liberating horses from the same, and locking the wheels, &c.—7th September. Six months.

C. B. Vignoles, of Furnival's Inn, London, and J. Ericsson, of Brook Street, Fitzroy Square, Middlesex, for certain additions to the engines commonly called locomotive engines.—7th September. Six months.

W. Cook, of Redcross Square, Cripplegate, in the City of London, for improvements on cocks for supplying kitchen ranges and cooking apparatus with water, &c., to be called "fountain cocks."—7th September. Six months.

H. G. Pearce, of Liverpool, R. Gardner, and J. Gardner, of the same place, for an improved fid.—7th September. Six months.

J. Chadley, of Gloucester Street, Queen Square, for improvements in making bricks, tiles, and chimney bars, applicable to the building or erecting the flues of chimneys.—13th September. Six months.

S. Smith, of Wilton Crescent, Hanover Square, for improvements in Chimneys.—14th September. Two months.

W. Church, of Haywood House, Birdsly Green, near Birmingham, for certain improvements in the construction of boats and other vessels, a part of which improvements are applicable to the construction of carriages.—21st September. Six months.

F. Molyneux, of Hampstead, and W. Bunday, of Kentish town, for certain improvements in machinery for spinning and twisting silk and wool, and for roving, spinning, and twisting cotton, flax, hemp, and other fibrous substances.—21st September. Six months.

J. Harrison, of Wortley Hall, York, and R. G. Curtis, of the same place, for certain improvements in glazing horticultural and other buildings, and in sash bars and rafters.—6th October. Six months.

C. Derosne, of Leicester Square, for certain improvements in extracting sugar or syrups from cane-juice and other substances containing sugar; and in refining sugar and syrups. Partly communicated by a foreigner.—29th September. Two months.

M. Donovan, of Dublin, for an improved method of lighting places with gas.—6th October. Six months.

Lieut. Col. L. Walker, C. B. of Cumming Street, Pentonville, for a machine or apparatus to effect the escape and preservation of persons and property in case of fire or other circumstances.—6th October. Six months.

R. Perring, of Exmouth, Esq., for an improvement or improvements on anchors.—6th October. Six months.

J. Heaton, W. Heaton, G. Heaton, and R. Heaton, of Birmingham, for certain machinery, and the application thereof, to steam engines, for the purpose of propelling and drawing carriages on turnpike roads, and other roads and railways.—6th October. Four months.

J. Dickenson, of Nash Mill, in the county of Hertford, Esq., for an improved method of manufacturing paper by means of machinery.—6th October. Six months.

W. A. Archbald, of Vere Street, Cavendish Square, for an improvement in the preparing or making of certain sugars.—13th October. Six months.

D. Napier, of Warren Street, Fitzroy Square, for certain improvements in printing and in pressing machinery, with a method of economising the power applicable to the same, which method of economising power is also applicable to other purposes.—13th October. Six months.

F. C. Jacquemart, of Leicester Square, Esq., for improvements in tanning certain descriptions of skins. Communicated by a foreigner.—20th October. Six months.

J. B. Sharp, of Hampstead, Esq. and W. Fawcett, of Liverpool, for an improved mode of introducing air into fluids for the purpose of evaporation.—20th October. Six months.

A. Craig, of Ann Street, Saint Bernard's, in the county of Mid Lothian, for certain improvements in machines or machinery for cutting timber into veneers or other useful forms. Communicated by a foreigner.—20th October. Six months.

A. Ure, of Burton Crescent, Middlesex, for an apparatus for regulating temperature in evaporization, distillation, and other processes.—20th October. Six months.

A. Ure, of Burton Crescent, Middlesex, for an improvement or improvements in curing or cleansing raw or coarse sugar. —20th October. Six months.

A. Ure, of Southampton Row, Middlesex, for an air-stove apparatus for the exhalation and condensation of vapours. —20th October. Six months.

S. Clerk, of South Down, Brixham, Devon, for certain improvements in making or preparing saddle-cloth and girths, for keeping saddles in place on horses and other animals of burthen.—20th October. Six months.

Sir T. Cochrane, Knight, (commonly called Lord Cochrane,) of Regent Street, for his invented apparatus to facilitate excavating, sinking, and mining.—20th October. Six months.

T. Mason, of Great Portland Street, Middlesex, for an improvement in the manufacture of painting brushes, and other brushes applicable to various purposes. —20th October. Six months.

S. Clegg, of Sidmouth Street, Gray's-Inn-Lane, for an improved gas-meter.—20th October. Six months.

H. Calvert, of Lincoln, for an improvement in the mode of making saddles, so as to avoid the danger and inconvenience occasioned by their slipping forward.—26th October.—Two months.

J. Shores, of Blackwall, Middlesex, for an improvement on tackle and other hooks, which he denominates "the self-relieving hooks."—1st November. Two months.

J. Collinge, of Lambeth, Surrey. for an improvement on the apparatus used for hanging or suspending the rudders of ships or vessels of different descriptions. —1st November. Six months.

B. Cook, of Birmingham, for an improved method of making a neb or nebs, slot or slots, in shells or hollow cylinders of copper, brass, or other metals, for printing calicoes, muslins, cloths, &c.—1st November. Six months.

L. Aubrey, of Two Waters, Herts., for improvements in cutting paper.—1st November. Six months.

J. Bowler, of Castle Street, Southwark, for improvements in machinery employed in the process of dyeing hats.—1st November. Two months.

J. Nott, of Schenectady, in the State of New York, but now of Bury Street, St. James's, Middlesex, Esq., for improvements in the construction of furnaces, &c.—Communicated by a foreigner.—4th November. Six months.

T. Bramley, and R. Parker, both of Mousley Priory, Surrey, for improvements on locomotive carriages, &c., applicable to rail and other roads.—4th November. Six months.

A. Bell, of Chapel Place, Southwark, for improvements in machinery, for removing wool or hairs from skins.—4th November. Six months.

A. W. Gillett, of Birmingham, Warwick, for improvements in the construction and application of wheels to carriages, &c. Communicated by a foreigner. —4th November. Two months.

G. Bompas, of Fishponds, near Bristol, Esq. M.D., for a method of preserving copper and other metals from corrosion or oxidation.—4th Nov. Six months.

J. Gibbs, of Crayford, Kent, Esq., for improvements in evaporating fluids, applicable to various purposes.—6th November. Six months.

J. Hall, the younger, of Dartford, Kent, for an improved machine for the manufacture of paper. Communicated by a foreigner.—9th November. Six months.

G. Minter, of Princes Street, Soho Middlesex, for an improvement in the construction of chairs.—9th November. Six months.

H. Pratt, of Bilston, Stafford, for improvements in the manufacturing of quarries.—11th November. Six months.

Sir T. Cochrane, Knt., of Regent Street, for an improved rotary engine, to be impelled by steam, and which may be also rendered applicable to other purposes.—11th November. Six months.

C. S. Cochrane, of Great George Street, Westminster, Esq., for improvements in the preparing and spinning of cashmere wool. Communicated by a foreigner.—13th November. Six months.

J. Tyrrell, of St. Leonard's, Devon, for a method and apparatus of setting sums, for the purpose of teaching some of the rules of arithmetic.—13th November. Six months.

T. Sands, of Liverpool, for improvements in spinning machines. Communicated by a foreigner.—18th November. Six months.

J. Revere, of Weybridge, Surrey, for an improved method of protecting iron chain cables, iron boilers, and iron tanks from the corrosion produced upon them by the action of water.—27th November. Two months.

W. Church, Esq. of Hayward House,

Warwick, for improvements in apparatus for propelling boats, &c. and also applicable for the purposes of evaporation.—29th November. Six months.

R. Dalglish, jun. of Glasgow, for improvements in machinery for printing calicoes and other fabrics.—6th December. Six months.

H. Blundell, of the Town of Kingston-upon-Hull, for improvements in a machine for grinding or crushing seeds and other oleaginous substances, for the abstracting of oil thereform, &c.—6th December. Six months.

R. Edwards, of Dewsbury, Yorkshire, for an improvement on, or substitute for glass, sand, emery, and other scouring paper.—6th December. Six months.

S. Brown, of Billiter Square, London, for improvements in the means of drawing up ships and other vessels from the water on land, and for transporting or mooring ships, vessels, or other bodies on land from one place to another.—6th December. Six months.

J. G. Lacy, of Camomile Street, and S. Davis, of East Smithfield, London, for improvements in the construction of guns and fire arms. — 6th December. Six months.

J. Dixon, of Wolverhampton, and J. Vardy, of the same place, for improvements in cocks for drawing off liquids.—13th December. Two months.

T. Walmsley, of Manchester, for improvements in the manufacture of cotton, linen, silk, and other fibrous substances. —13th December. Six months.

W. Needham, of Longour, Staffordshire, for improvements in machinery for spinning, doubling, and twisting silk, and other fibrous substances.—13th December. Six months.

S. Parlour, of Croydon, Surrey, for improvements on lamps, which he denominates "Parlour's improved Table Lamps."——13th of December.——Two months.

J. L. Benham, of Wigmore Street, London, for improvements in shower and other baths. Communicated by a Foregner.—13th December. Six months.

R. Witty, of Basford, Staffordshire, for improvements for propelling carriages, vessels, &c. by steam.—13th December. Six months.

B. Redfern, of Birmingham, Warwickshire, for a lock-break-off and trigger upon a new and improved principle, for fowling-pieces, muskets, &c.—17th December. Two months.

A. Graham, of West Street, Finsbury, London, for improvements in the application of springs for carriages. Communicated by a Foreigner.—17th December. Six months.

Daniel Papps, of Stanley End, machine-maker, for improvements in machinery for dressing or roughing woollen cloths.—23rd December. Two months.

W. Wood, of Summer Hill, Northumberland, for the application of a battering ram to the purpose of working coal in mines.—23rd of December. Four months.

M. E. A. Pertius, of No. 56, Rue du Bac, Paris, spinster, for the fabrication or preparation of a coal fitted for refining and purifying sugar, &c.—23rd December. Six months.

J. Ferrabee, of the Thrupp Mill and Foundry, in Stroud, Gloucester, engineer, for improvements in machinery for preparing the pile or face of woollen or other cloths requiring such a process.—23rd December. Six months.

☞ *Lists of the New Patents granted subsequent to this date are given at the end of each month. For the first of these monthly lists, see* No. 390, *for 29th of January*, 1831.

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